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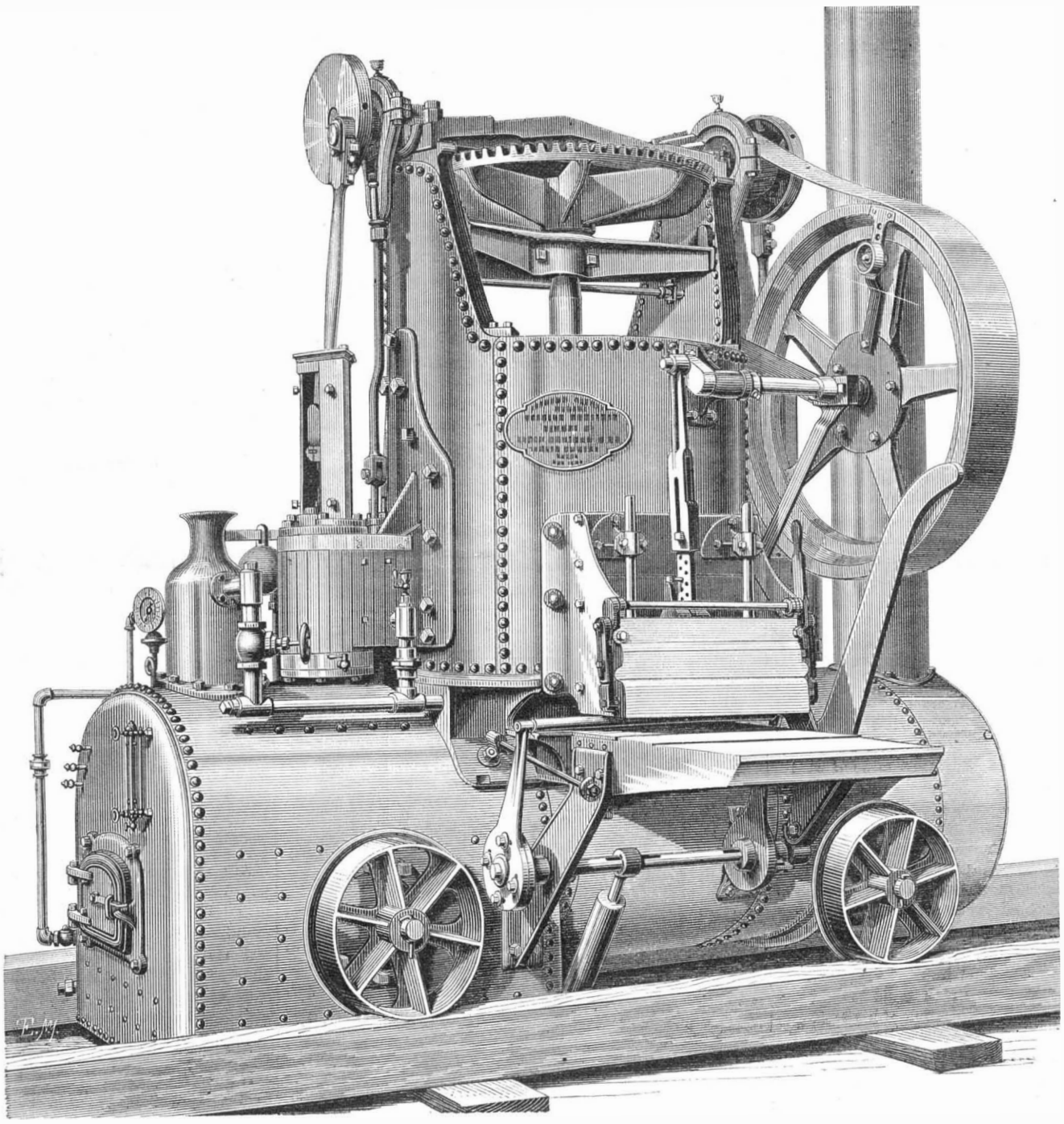
Improved Portable Steam Brick Machine.

This machine was illustrated and described on page 321, Vol. XXI., of the SCIENTIFIC AMERICAN, in which article its claims to superiority were fully set forth. The illustration referred to was from the original model of the machine, whereas the engraving we herewith present is from a photograph of a full sized machine, put in operation last season at Columbus, Ohio, and used for making the brick for the Ohio State Central Lunatic Asylum, one of the largest, if not the largest, structure of the kind in the United States, requiring over twenty-five millions of brick in the walls. It will be observed that the engraving exhibits some important improvements in its construction.

The general construction of the machine is as follows: The clay mill is placed on top of the boiler. It is composed of an outer and inner wall of boiler iron, between which water circulates for feeding the boiler, as well as for tempering the clay. A cock in the pipe under the cog wheel, which extends across and over the top of the clay, regulates the supply of water required to further wet the clay in the process of tempering it, while a steam pump on the back side of the machine supplies the water to this annular space in the clay mill, and also feeds from it the boiler. The form of the clay mill gives the requisite framing and strength for the attachment of engines and combination of the working devices. The steam cylinders are attached on opposite sides of the clay mill. These cylinders were, in the original model and machine, attached to the boiler, the expansion of which by heat tended to disturb the allignment of the working parts. The present position of the cylinders obviates this difficulty, and is a marked improvement on the original design. Improvements in the guides for the crossheads have also been made, by which no dust or grit can get to them, as the opening shown in front of the crossheads is closed by a door. The size of the boiler has been increased, the fire box greatly enlarged, while the whole boiler is built of heavier iron.



WINN'S IMPROVED PORTABLE STEAM BRICK MACHINE

As shown in the engraving, the machine is a boiler, engine, and brick machine combined; the whole placed upon wheels, so that it can be moved upon a track on the yard from one "pit" to the next. The boiler is 25 horse power, the cylinders are each 8½ inch bore, and the pistons have a stroke of 14 inches, and make from 40 to 60 strokes per minute.

The operation of tempering the clay, molding, and delivering the brick in molds upon the table, in front of the machine, is entirely automatic.

Reference to the engraving will show that the pinion on the longitudinal shaft (driven by the engines) drives the large bevel wheel upon the mixing shaft with its knives rotating among radial bars on the inner side of the clay mill; the clay is forced, by means of strong scroll wipers on the bottom of the shaft, into the press box in front of the clay mill, in which the follower is worked up and down by the crank on the shaft of the large pulley driven by a belt from the small pulley on the engine shaft.

The mold, when full, is forced out from under the follower at the proper moment, by the roller in the ends of the arms extending up from the counterpoised rock shaft, which is actuated by the lever, receiving intermittent motion from the trip wheel on one of the arms of the large pulley. The lever, trip, wheel, and arms, carrying the mold roller, are all adjustable, and the pressure can be instantly increased or diminished and varied from one to six inches, by means of the pin at the end of the connecting rod of the follower. The whole construction of the machine is substantial and very simple, and the slow motion of the engines and moving parts makes it very durable.

The patentee claims, simply, to make a first class common building brick upon the same principle, but superior to the best hand made brick, and at a much less cost. After a large experience, he does not consider the principle, upon which "dry clay" brick and "stiff clay" brick are made, as good as the method of the hand makers, which he, to all intents and purposes, carries out in this machine, namely, thoroughly tempering the clay and using sand upon the molds. The use of water and a thorough mixing of the clay to the consistency suitable for molding it into form, in his opinion, is the proper preparation for the chemical reaction which takes place in burning, and is necessary to make the brick homogeneous, even in texture, and free from grain, that they may be easily cut with the trowel to any desired shape, and obtain in the process of burning that porosity necessary to prevent the action of extreme heat and cold from expanding, bulging, or contracting the walls, or crumbling the brick.

To practical men, it is unnecessary to explain that sand, in the manufacture of brick, is a chemical necessity, but aside from this and its mechanical convenience in molding, it gives to the brick, after being burned, a sufficiently rough and granular surface to retain the mortar, the lime in which, under pressure of the weight of the wall, fills up the cells or interstices, and naturally and chemically adheres to the sanded surfaces.

The machine has been in use four seasons, and, according to numerous testimonials from practical brick makers now using it, makes 40,000 brick per day.

The proprietors also build the machine separate and unattached to a boiler or engine, which may receive power from a pulley on a line of shafting driven by a stationary engine or from other convenient source.

The machines are manufactured for the proprietors by John Cooper & Co., Mount Vernon, Ohio. For further information, or for machines, address Wright & Winn, Lock Haven, Pa.

Traction Engine.

Mr. John Greenslade, of Steeple-near-Maldon, England, has invented and patented, through the Scientific American Patent Agency, improvements designed for rendering traction engines, especially those used on common roads, well suited for descending or ascending steep inclines. This is sought to be accomplished by mounting the boiler, together with the engine, so that it may be maintained in a horizontal position, and thus keep the water always at the same level, whatever may be the inclination of the framing, whereby the priming of the engine is prevented, as well as injury to the fire box and tubes from excessive heat, such as is the case when the boiler is fixed to the framing in the usual manner.

The inventor connects the boiler and working parts of the engine so that they may all move together, and provides the boiler to which the said working parts are attached with pivots, trunnions, or an axis or axes, placed at or near the center or otherwise, so that one end of the boiler may counterbalance the other. The engine and boiler oscillate in bearings on the framework, which is provided with driving and steering wheels as usual.

The position of the boiler can be regulated by means of a screw or screws mounted to the foot plate and working in nuts carried on the rear end of the boiler, or the boiler may be adjusted in any other equivalent manner by means of which its rear end can be raised or depressed, as required, according as it is ascending or descending an incline. The front end of the boiler is also suitably supported for the purpose of avoiding undue strain on the oscillating bearings or framing when the engine is in motion. The cylinder may be mounted in any convenient position, and motion is transmitted therefrom to the driving wheels by means of chain or other gearing, through the medium of a pulley mounted on one or both of the boiler trunnions, pivots, or axle, which is prolonged to form an axis for the pulley; or any other equivalent arrangement may be adopted. By the above means, the working of the engine is not in any way affected by the variable positions of the boiler. The pulley for transmitting motion to the driving wheels being mounted at the center of oscillation of the boiler, the distance between the main shaft and driving pulley, as well as the strain, is at all times the same. The carriage and boiler can be carried on springs or not, as desired. It is claimed that these engines will be found very serviceable for the work performed by portable engines. One or more windlasses can

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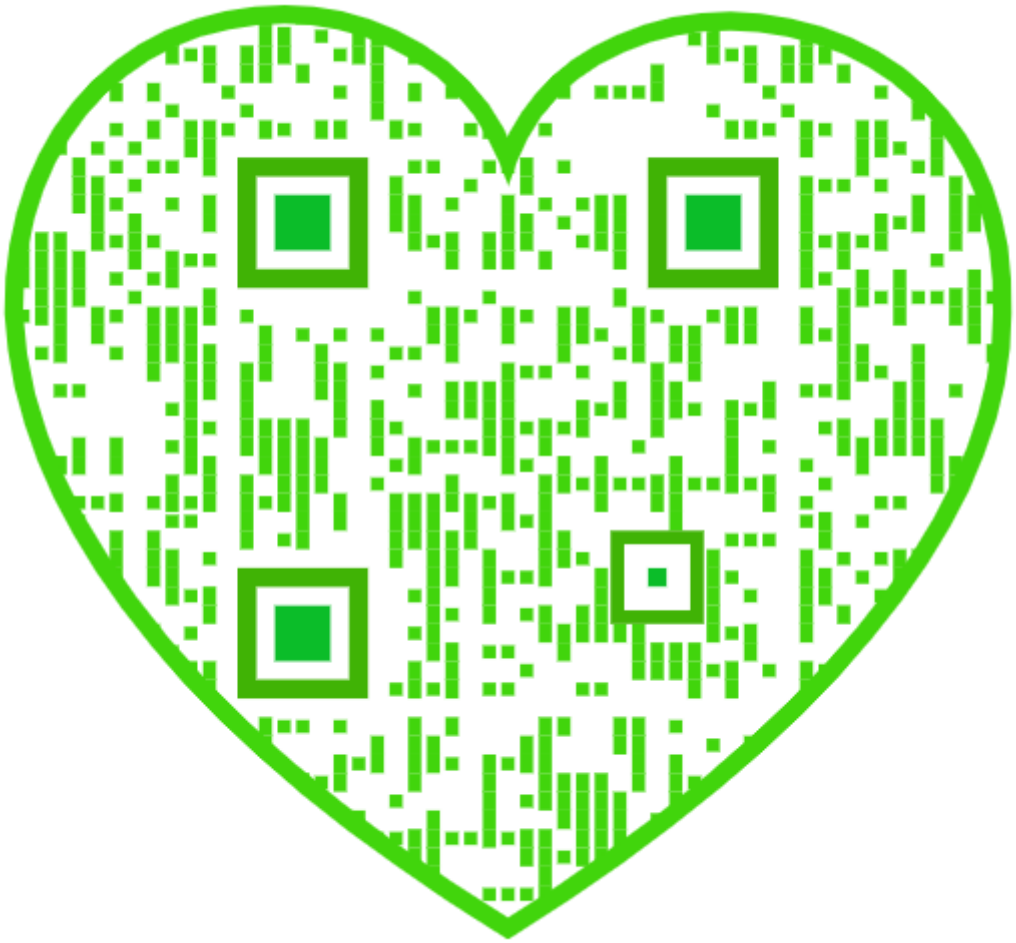

be attached under the framework, and can be driven by suitable gearing from the intermediate wheel, rendering them more suitable for agricultural or other like purposes.

STOVE MANUFACTORIES IN TROY.

One of the most interesting of a series of articles, describing the manufacturing industries of New York State, now in course of publication by the New York *Times*, is devoted to an account of the stove and other iron productions of Troy and its vicinity.

There are in Troy fifteen stove founderies, whose annual consumption of pig iron is about 20,000 tuns, and of coal, 10,000 tuns. They make 150,000 stoves a year, and give employment to over 1,000 moulders, about 250 mounters and fitters, 300 laborers in different departments of the business, and about 200 skilled pattern makers. This pattern making is quite an important branch of the stove business, a vast number of patterns being made and shipped to other towns in all parts of the country. The pattern is half the battle in casting stove plates, and has to be as true as possible, and to allow for expansion and contraction in the casting taken from it.

The extent and rapid growth of this trade may be judged from the statement that Troy now manufactures and sells annually 150,000 stoves, and there is, of course, no necessity for fetching any more down from Vermont, whence, thirty years ago, a cargo of stoves arrived in Troy for shipment west, over the Erie canal. They came down the Champlain canal from Vermont, and the young supercargo in charge of them is now a partner in one of the principal stove founderies in the city.

The stove business of Troy, prior to 1845, was limited to four establishments, the oldest of which dates back so far as 1812. A Mr. Arnold was the founder of it. He made his first essay in casting stove plates in 1814, and during that year the molders he employed were deserters from the British army, which had recently been defeated at Plattsburgh. Mr. Arnold conducted a limited business for some years, and then turned his foundery over to Mr. Stratton, a gentleman who, in after years, became foreman at the West Point foundery, and in 1840, he surrendered his interest in the foundery to James Wager, at present the senior partner in the firm of Wager and Fales, and generally regarded as the oldest stove manufacturer in the United States—not in point of years, but from the time he has been engaged in the business. From 1840 to 1854, he encountered many trials and pecuniary embarrassments; but he fought his way through them all, enlarged his foundery, quadrupled his business, and he secured a fortune before he left his own foundery in 1855, in spite of the competition created by the erection of half a dozen new founderies between 1846 and 1850. During those years, he developed marked and valuable improvements in cooking and heating stoves, bestowing great pains on the production of a smoother and better quality of castings. His stoves soon became popular and thousands were shipped to California and Oregon; a steady sale for them was found in Australia, and Canada became an extensive buyer in the Troy stove market. Alas! no longer so; the heavy duty on stoves from the States now closes that market to Troy New England and the South also began to draw a large supply from Troy; while the West began to make itself felt in the Troy market, and the shiploads of emigrants, arriving every week at Castle Garden, pointed significantly to that vast section of the country as a future mine of wealth to the stove founderies. Of late years Mr. Wager has had a fine business in the manufacture of stoves in association with Mr. Fales, under the style of Wager, Fales & Co.

Another great pioneer in the Troy stove business, but as an inventor rather than as a manufacturer, was Philo Penfield Stewart, born in Sherman, Fairfield County, Conn., in 1793. In his boyhood Mr. Stewart exhibited a strong fancy for perfect mechanical workmanship, and was constantly contriving and making miniature machinery. For this reason, I suppose, his parents compelled him to serve a seven years' apprenticeship to a saddler and harness maker, and were astounded to find out, at the expiration of his sentence, that the repository of strap oil did not agree with the lad's tastes. Of course it didn't. The boy's mind was bent on machinery, not on stitching bridles. We next hear of him working as a missionary among the Indians, and at thirty-five years of age, as founding the village and college of Oberlin in Ohio. About this time, poverty compelled him to practice economy, and after some study of cooking cooking stoves he succeeded in constructing one which only consumed three small sticks at a time. It was a stove with a fire box hanging in the oven, and was patented by him in 1838 Gradually Mr. Stewart turned his entire attention to the invention of new stoves; and when he died in 1868 the names of Stewart's stoves made a formidable list in the catalogue of stoves manufactured by Fuller, Warren & Co., who hold all his numerous patents. The dumping grate cooking stove was the result of his greatest efforts, and its capabilities are statistically set forth in the following extract from one of the journals of the day:

There were 266 loaves of bread baked, each loaf weighing 1¼ pounds, aggregating 332 pounds, or 50 pounds more than the equivalent of a barrel of flour; 72½ pounds of beef perfectly roasted; one bushel of potatoes baked and boiled; 2 barrels of water heated to boiling temperature, all accomplished with 24½ pounds of coal, at 3½ in the afternoon.

This is cooking by wholesale. If the master saddler and harness maker, to whom Stewart was bound, lived long enough to read the above extract, his ideas concerning the ability of the apprentice whom he thought so stupid must certainly have been considerably modified. Well, greater men than Mr. Stewart have been pronounced fools by their schoolmasters. Bacon was imprisoned for years on account of his scientific researches. DeCamp and others were confined as lunatics. Mr. Stewart may then be said to have succeeded "excellently well," considering the adverse influences which entramelled his early career.

A man who cannot suit himself with a stove in walking along River street Troy, must be one of those creatures—too often to be met—impossible to please. He could pick and choose between base burners, self feeders, gas consumers, patent bakers, hot closets, reservoirs, and a hundred other sorts; and if he happened to be a free handed, liberal minded kind of fellow, he would, in all probability horrify his economical Western wife by taking home one of each pattern.

The leading firm in the Troy stove business is that of Fuller, Warren & Co., in which Geo. A. Wells and Walter P. Warren are also active partners. Their foundery is on the Albany and Troy line, immediately adjacent to the celebrated Rensselear iron works, on the outskirts of the city, is known as the Clinton stove works, and is on a most extensive scale. It is a large brick structure, covering between five and six acres of ground, and furnishes employment to 400 men. The molding rooms are the finest I have seen. They are four in number, two being 150 feet square, and the others a little smaller. Four cupolas, with an aggregate capacity of seventy tuns a days, supply the molten metal for the castings. About forty tuns in the day is the average quantity run. During the busy months of the year, their labor pay roll amounts to $6,000 and $7,000 a week. Their great stoves are, of course, the different "Stewart" patterns, of which they make about 10,000 a year; but they also manufacture any number of furnaces and ranges. They have special arrangements with Mr. James A. Lawson, which give them the exclusive privilege of making the Lawson furnaces, including the "Diamond" and "Ruby" furnaces. Mr. Lawson took out his patent in 1864. Since then $800,000 worth of his furnaces have been made and sold by Fuller, Warren & Co.; and this year they fully anticipate making $350,000 worth of them. They are surface burners. Mr. Lawson, while fully appreciating the merits of base burning as applied to parlor stoves, maintains that the principle is not suitable for furnace heaters; and that a greater amount of heat can be obtained from a surface burner of the same power. These furnaces weigh from 450 to 2,800 pounds, and find a ready market, like the "Stewart" cooking stoves, from Bangor to San Francisco. Aye! even the delicate toes and fingers of the vailed ladies of the harems of Constantinople are warmed on a chilly afternoon by one of Lawson's furnaces.

These few figures and facts are all that are needed to point out the thriving condition of the city of Troy, and to call attention to the talents of her manufacturers whose wares are known in all parts of the world.

Colorado---Narrow Gage Railway.

The Colorado road, which has been constructed with great rapidity for seventy-five miles south of Denver, is intended ultimately to be built along the base of the Rocky Mountains to Sante Fe, thence to Albuquerque, thence to El Paso on the Mexican border, thence to Chihuahua and finally to the City of Mexico—a total distance of about 1,750 miles. When completed, it will be one of the most important lines of railway on the Continent.

Mr. Bowles says that the cost of building this road has been but $13,000 a mile, while the Kansas Pacific, which traverses a like region of country, cost $32,000. As to its working, he says:

The road and its trains, in the first place, look like a railway plaything in contrast with the broader and heavier tracks and larger cars of the accustomed lines; delicate and dainty, they seem almost too faint and feeble for the hard, quick work to which they are called, and especially unequal to the great contest which they have invited. Yet so far, surely they are performing their task with ease, with comfort, with celerity and success. The track bed of the narrow gage is 6 feet wide, as against 9; the distance between the rails 3 feet, as against 4 feet 8½ inches; the ties are 6 to 6½ feet, as against 8; the rails 30 pounds to the yard, as against 56; the engines 12 to 16 tons, as against 25 to 30 tons, putting about half the weight on the drive wheels that the large locomotives do; the passenger cars with 8 wheels, and carrying 32 passengers, weigh 6 tuns, as against 18 tuns, 8 wheels and 50 passengers; and the freight cars, thus far introduced, weigh 2 tuns, run on 4 wheels and carry 4 to 5 tuns of freight as against cars weighing 9 tuns on 8 wheels, and capable of 10 tuns load. Where four passengers sit in the ordinary car two three are seated in the narrow ones, two on one side and one on the other of the passage way, the car being divided in the middle by a door, and the seats for two and one respectively, being reversed in the two sections, so as to balance the carriage. The cars at first introduced are 7 feet wide, and 10½ feet high from rail to top. They prove a trifle more compact than is necessary, and not quite generous enough in accommodations for passengers; but this evil is being remedied in new cars now constructing; while sleeping cars and day drawing room cars can be made for the narrow gage roads, which will accommodate still more persons in proportion to their size and weight, than the ordinary cars of this character now do.

Starch.

According to the views of Mr. Alexander Macrae, of Liverpool, there is now a good opportunity for American starch manufacturers to enter the British market. He says:—"Starch crystals, whether made from wheat or potatoes, have been selling during the last ten years at an average price of $4.80 gold per 112 pounds, packed in flour barrels lined with blue paper. To-day the value is $7.20. The cause of this advance is due, in one instance, to the great falling off in the supply of Dutch farina or potato flour, and in the second instance, to the upset of agricultural development on the Continent, caused by the late Franco-German war. These deficiencies cannot be recuperated for some time to come, not only because material difficulties have to be overcome, but because the exigencies of other trades arising from that war have more sterling claims over men and money.

This, then, would seem the proper time for the American manufacturers to introduce their starch and farina into this market, and to found for themselves a reputation which will not suffer when Continental manufacturers again attempt to compete.

We can take in Great Britain alone at least 100,000 tuns per annum, and it is this disposition, to deal to so large an extent in wholesale packages, that commends itself to manufacturers who are now harassed by limited sales, and the labor and expense of small packages."

How a Man Feels when Freezing.

During the recent cold weather, Dr. McMillan, a young dentist, while traveling from North Middletown, Ohio, to the adjoining town of Paris, was overcome by the intense cold, and came near being frozen to death. He narrates his experience, in the *Cincinnati Enquirer*, as follows:

"After having proceeded about three miles on my journey, my feet became very cold. By stamping my feet upon the floor of the buggy I imagined I was perfectly warm, as my feet troubled me no longer, and the cold sensations through my body ceased. I, however, felt dull and sleepy, like a man who is drunk. I didn't care for anything. At this point, I believe, I began to freeze, and ought to have known it, but felt so comfortable that I did not examine my situation. After I had driven about three miles further my hat was blown off, but, being in a hurry to reach Paris, I did not stop to hunt for it. When I had proceeded perhaps a mile further, letting the reins lie in the bottom of the buggy and paying no attention to my driving, my horse shied off the side of the road and ran upon a rock pile. I then attempted to get the lines and pull him off, when I discovered I had lost the entire use of my right, and could barely use the left hand; with this one I attempted to pull him off the rocks, but the buggy wheels being locked, I could not do it. I then got out of my buggy, and in doing so struck the bridge of my nose across the wheel and cut it severely. I then went to the head of the horse, took hold of the bit and attempted to pull him around, but he would not move. I then commenced to unharness him, with the expectation of pulling the buggy off the rocks myself, feeling all the time very sleepy. When I had almost completed the task of unhitching the horse from the buggy, the desire for sleep became so great that I could bear it no longer, and I laid down upon the rocks by the side of the horse and went to sleep. I must have lain there some fifteen or thirty minutes, when I was aroused by a colored boy who found me. Upon his asking me where he should take me, I told him to Paris, still not being aware of my critical condition. Upon arriving in Paris, my feet were put into cold water, which entirely, I think, cured them, as they do not hurt me. My left hand does not give me much pain, and I think will be all right in a few days; but my right hand was badly frozen, nothing seemed to do it any good, and I am afraid I shall lose three, if not four, of my fingers. Last night, when I arrived in Paris, I could give no account of myself, but this morning I remember every incident."

AIR CUSHION FOR THE FEET IN RAILWAY TRAVEL.—A writer to the *Medical Times and Gazette* refers to the fatigue of the limbs produced after a long railway journey as due mainly to the trembling motion of the floor under the feet, and states that, having suffered considerably from this abuse, he was induced to try the experiment of using the well known air cushion as a footstool. This answered so well that he has never travelled without using one in this way, and has found the effect to be a remarkable improvement.

If the air spring is good for the feet it must also be good for the whole body. Perhaps some ingenious person can devise a car seat, elastic throughout that will afford real comfort to the traveller.

IMPROVED CRUCIBLE.—A crucible for melting metal has been invented, which consists in providing the ordinary crucible of plumbago or other substance with a flue or passage from the bottom to the top, for allowing the heat to act, upon the center of the mass of metal contained in the crucible, more directly than it otherwise can. This passage is surrounded by a shell or tube of the same material of which the crucible is made. The inventor also grooves or indents or constructs the sides of the crucible, both inside and out, so as to form projections to interlock with the paste, clay, or other substance with which the crucible is coated, to cause the coatings to be retained much longer than they now are, thereby preserving the crucible much longer, and reducing the cost of melting steel or other metals.

MONSTER OF THE DEEP.—At Norwich, Conn., at a recent descent made by one of Mr. Fuller's divers in Shetucket, he fell, unexpectedly, into a fissure between the rocks at the bottom, nearly twenty feet deep. Here he was assailed by a large animal, half serpent and half fish, which snapped viciously at the eye plates of his helmet, and though repeatedly struck with an iron bar, was with difficulty driven away.

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INVENTIONS AND PATENTS CONNECTED WITH BUILDING.

This was the subject of a paper read at a meeting of the Inventors' Institute, London, on Jan. 4, by Mr. B. Fletcher.

Mr. Fletcher said: "I shall first take the entire building, and thence work to details. Probably I proceed in this form as it is the usual course pursued in designing buildings, bearing in mind, too, the injunction by the poet:

'Consider what you undertake,
And analyse it well;
And ever work from whole to part,—
Grand principle of master art,—
That makes that work to tell.'

Well, in what does the house of to-day differ from the house built one hundred years ago? I must be understood to mean the usual houses which are being built all over the kingdom, and not as alluding to an exceptional house here or there.

It is wise to imitate the prudent tradesmen who just now are 'stock taking;' and I am afraid, if we take stock, and look upon the houses of to-day and those built some one hundred years ago, like that I live in, we must not say merely that our predecessors built much stronger and better houses than we do, but also that the inventions and patents (grand as they are) have been so little utilized by builders that even in conveniences the old houses will almost equal the modern. It is strange that this should be so, if one considers the almost appalling number of inventions and patents that yearly are granted. Take, for instance, this country, and the average number per annum during the last ten years; a little over 3,000 applications were made, and of these more than 2,000 were granted. The number applied for last year was 3,500, and of these, according to the average, two thirds would be granted. Now see how slow Old England is. In the United States, for the year ending the 30th of September, 1871, 19,429 applications for patents were filed in the Patent Office (including reissues and designs), and as many as 12,950 patents were issued. Yet again, startling as this is, we find that this number was not so great as that of the preceding year. I notice the fees received during the year by the United States Patent Office amounted to 671,583*l.*

I cannot say what proportion of patents relates to buildings; but one sees from time to time in our professional papers a long list of such patents, so that, no doubt, the thought must arise in the mind of the public: Why, then, are not these inventions and patents more used?

I will explain. A man, if he can invent something which will enable him to produce cotton ½d. per pound cheaper, or some machine which shall be a perfect substitute for hand labor in some department where the demand is unlimited, may out of such single invention amass a great fortune. The one condition of such success is that the article manufactured shall be in great demand, and that his invention saves money in its production, or that he produces a better article at the old price, or that by his invention useless materials may be made available (for example, much iron is now used, by the application of the hot blast, that formerly was thrown away: I do not say to the improvement of the iron, but that formerly it could not be used at all). Now, you will notice in all cases the basis of large profit is from extended demand for the article. It is, therefore, evident that an inventor who turns his attention to patents, in connection with manufactures, has the prospect, if he succeeds, of larger profits than he who devotes himself exclusively to patents connected with buildings. This may account in some measure for the relative small proportion of inventions relating to building.

Having, then, shown that the inventive genius is somewhat allured from building patents by the temptation of larger gains, a few words will be well to indicate the difficulties that beset those who, having devoted their time to this class of patents, succeed in producing a valuable and useful one. The architect who is building a house probably goes to see the invention, likes it—thinks he will try it— hesitates—finally, probably, decides against its employment, from fear that it may not be successful. Yet, I think, little blame can attach to him; if the invention succeeds, the merit is the inventor's; if it fails all the blame falls on him for selecting such a "fandangle, stupid thing;" such will be the language his client may use to him. He, therefore, has no inducement to recommend a novelty, as it cannot benefit him in his practice, and by so doing he may lose a client. Is it, then, to be wondered at that we are so conservative in our decisions?

Cui bono, you may ask, all this explanation if there is no remedy? Well, I have a remedy. It is the formation of a commission, with unpaid members, who should inquire into patents or inventions when (and not till then) the results are being manufactured for sale, and should test them, and should also invite the opinion of all who use them; and these commissioners from time to time should report the result of their investigations. I would base their operations very much on the mode of proceeding adopted by the commissioners of the *Lancet;* and I think my hearers will agree with me, that these commissioners have done much good. I feel sure that the commissioners I propose would be of great service, if the gentlemen were carefully selected.

I have said that houses now are built very much as they were years ago. Go into any ordinary house in any of the suburbs of London, and what difference will you find? Why, the house is as nearly as possible a counterpart of any old house, except that it is not so strongly built. Shutters are gone, and perhaps instead of the sash bars (which, by the bye, some architects are putting in their new works), a large square of plate glass. In fact, the house when ready for letting usually has not one of the modern appliances.

This being so, let us consider what a house should be. It should first have a good damp course, to prevent damp arising. Every room should have an air flue to let the foul air escape, and those rooms where gas is burnt should also be provided with an external ventilator. The pipes from closets should be carried up in an inside recess, to prevent frost, and should be accessible by merely opening the wooden covering. The bells should also be so carried up. There should be a hydraulic lift where the house is large. Water, hot and cold, should be on the bedroom floors, and in the lavatories attached to the water closets. Where cupboards are put, they should be fitted with regard to the use they will be put to. For instance, in bedrooms they may be made like wardrobes. To see what is being done out of this country, look at the Americans. Take one of their houses: not a servant (or help, as I should perhaps call them) wanted up stairs, every room always ready, except the dusting; the bed a spring mattress, no making required; a tap to regulate the temperature of the room; washstand, with hot and cold water laid thereto, and waste therefrom; so that, positively, while we are quite helpless without our domestic servants, they can do everything upstairs without servants. Surely the picture I have drawn shows how much we have to do before we can call the Englishman's castle really a home fit for this century. Well may I quote those lines:

'So hard
The growth of what is excellent; so hard
To attain perfection in this nether world.'.

As to concrete building, this formed an important portion of the paper, and Mr. Fletcher took great pains in showing its advantages and disadvantages, as compared with the ordinary building materials. He stated the former to be cheapness, strength, and durability, rapidity of construction, and economy of space; the latter, its liability to failure from the use of improper materials, or from the want of knowledge and proper care, and the limits which the material and method impose on architectural design and decoration. He objected to the imitations he had seen of stone fronts by concrete, with core of that material to form moldings, and facing it with Portland cement. Such a method, he considered, would soon bring concrete building into disrepute. There is little doubt that concrete building, so far from being necessarily a "sham," may be made an admirable and useful material, capable of perfectly legitimate treatment with good results. The different kinds of apparatus used in the erection of concrete buildings were treated of. Amongst the peculiar features of concrete buildings was mentioned that with regard to steps; four of Portland stone pounded to one of cement were stated as the proportion. The cost of these steps is about half that of Portland stone. Seven to one is the usual proportion for general building, but four to one is used for coring out for mouldings, and two to one where the projection is very great. An advantage in regard to sanitary arrangement was mentioned, namely, that it will take any number of flues for any purposes anywhere; so solid is the material, that flues may come within three inches of the outer face. All fitting into vertical grooves must be avoided, as the swelling of the cement prevents the lifting of the apparatus.

Many examples of locks and their fastenings, door springs and rollers, water bars, casement fastenings, revolving shutters, electric bells and domestic telegraphs, cottage ovens, stoves, lifts and hoists, dust shoot boxes, pipes, paints and enamels, etc., were exhibited and explained. An ingenious letter box was also introduced, and he concluded his remarks with this observation:

"I think, however, there is a grand future for architecture, but it must be by striving to combine in buildings all the scientific inventions of the day, to do so continuously and with judgment; and herein new forms will be created by the use of new materials, if only the desire be present not to be slavishly bound by precedent, but earnestly to strive to make the requirements of science express themselves in our works. Whilst, therefore, I contend no architect should have or invent any patent, or have any interest in any, for the reason that he may be tempted to use it when some better thing may have been discovered (and this merely from the natural love we all have for the children of our brain), he should be ever willing to experiment with all the inventions of others, and thus give them aid. I have learnt much while pursuing my investigations, and if I but lead others to investigate for themselves, I am confident they will also learn much."

Carr's Disintegrating Machinery.

At a recent meeting of the Institution of Mechanical Engineers, held at Birmingham on the 25th of January, the first paper read was a "Description of the Disintegrating Flour Mill, and Machine for Pulverizing Minerals, etc., without grinding, crushing, or stamping," by Mr. Thomas Carr, of Bristol. In this process of disintegration, the particles of the material operated upon are shattered in mid air by a succession of blows delivered with extreme rapidity in opposite directions, and are thus pulverized by the force of the blows alone, without being subjected to the compression or friction which accompanies the ordinary processes of grinding, crushing, or stamping the material between two surfaces. The disintegrator consists of a pair of disks rotating in contrary directions upon two shafts situated in the same line; the opposing faces of the disks are studded with a series of short projecting bars or beaters, arranged in successive concentric rings or cages; and the rings of beaters fixed in one disk, intervene alternately between those fixed in the other disk, and revolve in the opposite direction. The material to be pulverised is supplied through an opening in the center of one of the disks, and receives from the innermost rings of beaters a centrifugal motion propelling it towards the circumference of the disks; in its course through the machine, it encounters successively the several rings of beaters revolving alternately in opposite directions at a high speed, and the particles are thus dashed violently by each beater against the beaters in the next outer ring running in the contrary direction, whereby the material is effectually broken up and reduced to powder. In this mode of action, by the free blows of the beaters upon the material, the friction and compression between the machine and the material, which are involved in all grinding, crushing, or stamping processes, are avoided, as the material is not acted upon between a pair of surfaces; and the whole force of the blows given by the revolving beaters is usefully expended in pulverizing the material. Disintegrating flour mills upon this construction have now been a year in regular work with complete success, a single machine of 7 feet diameter being found to do the work of twenty-seven pairs of millstones, and produce the same percentage of flour from the wheat, with a remarkable saving in cost of production; the quality of flour, moreover, is decidedly superior, owing to the absence of the compression that accompanies grinding by millstones; and in consequence of the bran being scaled off in larger flakes than in grinding, it is more perfectly separated from the flour in the subsequent dressing process. Smaller sizes of the disintegrating machine have been several years in use for pulverizing various mineral substances, such as artificial manures, calamine and blende ores, auriferous quartz, and rock asphalte; also for breaking up cattle food, such as oil cake, etc., and for mixing in sugar factories different shades of moist sugar, and for mixing the materials for making mortar; and the machines have proved very successful for these purposes. Models were exhibited of the machine, with specimens of a variety of materials pulverized by it, and the samples of the flour produced by the disintegrating flour mill.

American Solar Eclipse Observations.

It appears from a recent official report of Professor Pierce of the Coast Survey, that the first total eclipse of the sun, visible in this country since the formation of the Government, was that of June, 1806. This was accurately observed at several points, and a valuable painting was made of it. We were not favored with another until that of November 30, 1834, which was observed by R. T. Paine, Esq., of Boston, at Beaufort, S. C. A third eclipse did not visit our country until 1860; hence, at that time this wonderful phenomenon was, for most American astronomers, a matter of hearsay. The path of the eclipse of July 18, 1860, was from Washington Territory to the northern shore of Labrador, and thence across the ocean to Spain. This eclipse was observed by expeditions organized under the Superintendent of the Coast Survey, and the results are published in the report for that year. It was also observed by the astronomers of several Governments abroad, and was the first total eclipse which was photographed. In 1868, British, French, and German expeditions were fitted out for the observation of a total eclipse in India. On this occasion brilliant discoveries were made in regard to the spectrum of certain rose colored prominences seen about the sun at such times, and these discoveries have been increasing in interest ever since. In 1869, another total eclipse was visible in the United States. It was observed by parties organized by the Coast Survey and other Government bureaus. The results were of high importance. Photographs of the entire corona were taken for the first time. The first observations were made upon the spectrum of the corona. The radial polarization of the corona was first observed with care, and the former knowledge of the subject was advanced in every direction. The results of these two eclipses were of such importance in regard to one of the chief scientific problems of our time, the constitution of the sun, as to excite the profoundest interest throughout the world.

THE ECLIPSE OF DECEMBER, 1870.

It was felt by everybody even casually interested in science that the eclipse of the year 1870 afforded an opportunity for removing the last obscurity from the subject of the corona, such as ought not to be let slip; the more so as no other eclipse was expected to be observed by a Government expedition from this country during this century.

In accordance with these views, Congress authorized the fitting out of an American expedition, similar to those to be sent out by Germany, France, Great Britain, Italy, and Spain, to study the phenomena of this eclipse.

It was decided to dispatch two parties—one to be stationed in the vicinity of Jeres, in Spain; the other, in the Island of Sicily, in the neighborhood of Catania. A large number of spectroscopic observations were made by both of these parties during the eclipse, with results establishing the correctness of the previous observations, especially the fact of the radial polarization of the corona.

BRICK DUST CEMENT.—In the Spanish dominions ordinary brick dust, made from hard burned, finely pulverized bricks, and mixed with common lime and sand, is universally and successfully employed as a substitute for hydraulic cement. It is a regular article of commerce, sold in barrels by all dealers in such articles, at the same price as cement. The proportions used in general practice are one of brick dust and one of lime to two of sand, mixed together dry and tempered with water in the usual way.

EVERY railroad station in England has a stairway or plate form, or some other means of crossing the track, and such persons as disregard the prescribed way and step upon the track are immediately seized and fined twenty-five dollars. In this way, the companies are saved many suits for direct and constructive damages.

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The Great Canal Reward.

Last year, it will be remembered that, the State of New York offered a reward of one hundred thousand dollars for the invention of any form for the application of motive power to the canal boats by which they could be economically propelled, as cheaply as by horses. The law was published in full in the SCIENTIFIC AMERICAN in May, 1871.

The Canal Commissioners have recently published a report, in which they say that they have received over 700 communications from all parts of the world in reference to power on canals; many models have been sent, some being the productions of women; some are valuable, but many are the results of inexperience, or are visionary. The Commission does not advise any change in the law, of the kind desired by such persons as think its objects cannot be secured as it now stands and is construed by the Attorney General. On the contrary, the Commission is of the opinion that compliance with all the present requisitions of the law should be insisted upon before the money should be awarded. All the time allowed by the law will be given to the competitors; but the Commission will adhere to the determination expressed at its first meeting, that boats in actual service, and not drawings or models, will be considered as competing for the money offered by the State.

The reward still holds good, and any person who desires further information upon the subject may address Henry A. Petrie, Secretary of the Canal Commission, Albany, N. Y.

THE COMBA SCURA BRIDGE---MONT CENIS RAILWAY.

We are indebted to *Engineering* for a view of one of the numerous bridges which convey the Mont Cenis Railway across the ravines and streams that interrupt its course. The Comba Scura bridge spans a singularly picturesque ravine in a spur of the Piedmontese Alps, and it crosses at a hight of 395 feet above the bottom of the valley.

The following are the principal dimensions of the structure:

Clear span between abutments	185	feet	2 inches.
Width	14	"	9 "
Depth of girders	18	"	0½ "

It was constructed to carry and sustain a test load of 4·5 tuns per lineal yard, with a deflection of $\frac{2}{3}\frac{1}{2}$ inch at a calculated strain on the iron of about 4 tuns per square inch. The weight of iron in the bridge is 201 tuns.

The Comba Scura bridge, as well as that of the Serre-de-la-Voûte, situated about 6½ miles further up the valley, was contracted for by Messrs. Kreeft, Howard & Co., of London and Turin, and both were constructed, from designs prepared by the Italian Government engineers, by Messrs. Fleet & Newey, Crown Boiler Works, West Bromwich, London, England.

MINING IN COLORADO.

A correspondent of the New York *Evening Post*, writing from Central City, Colorado, gives the following interesting ticulars:

ORE RAISED FROM THE VEINS.

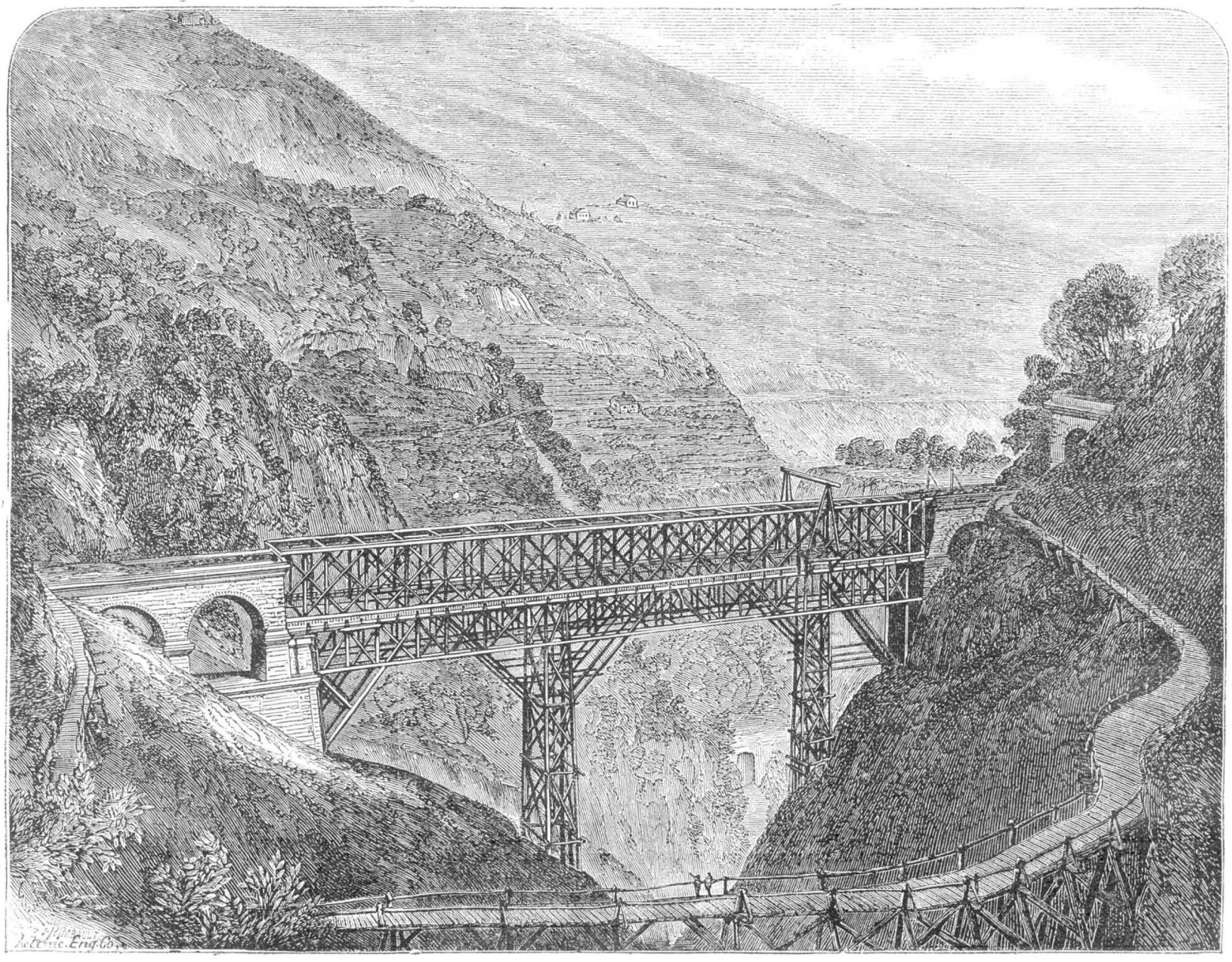
From the veins of Gilpin county alone nearly 600 tuns of ore are raised daily, or a total of 180,000 tuns annually. Nearly 500 lodes have been assayed or mapped in a circle of three miles in diameter; fully a thousand lodes have been recorded, and more or less work performed upon each. From fifteen to twenty miles of reputable lodes are known to exist, upon which there is not less than eight miles of shafting, the deepest shaft going eight hundred feet into the bowels of the earth. There is not less than twenty miles of drifting on these veins, following the ore deposit in the crevices. The assays of the territorial assayer amount to thousands, from samples of those leads. Averaging three hundred of these assays, samples of mill ore alone, taken as they were set down in the official register one year ago, would show this species of ore to be worth nearly $40 per tun. Averaging over two hundred assays of select ore, as they were made during the same time, the result shows a value of $130 per tun for such stuff. Then turning to the tailings, the refuse of ore put through the stamps, we find the average to be over $20 per tun, notwithstanding from ten to twenty per cent of the precious metals have passed away down the stream. Taking samples of this lost material in the streams coursing down to the plains, over $30 to the tun is found to be the average. Notwithstanding this extraordinary waste, the average shipment of bullion from this county trenches on $2,600,000 yearly, a production of $500 per year for each man, woman and child in this county.

MILLING GOLD ORES.

There are 83 stamp mills in this county, 185 engines in place, 4,367 horse power, and 1,597 stamps, of which there are over 800 in use, requiring 1,703 horse power. There are 39 engines used at the shafts of mines for raising ore from the veins and keeping them free of water; 12,000,000 pounds of freight, general merchandise, consumed in the county, and nearly 3,000,000 pounds of flour, all brought there to sustain the mining industry of the region, the product of which is mainly derived from milling the ores regardless of the waste alluded to. These mills are various in size, containing as high as fifty stamps and down to five, mostly driven by steam. The ore, broken into small fragments, is fed into a battery in which the stamps are raised and allowed to fall, crushing the ore fine enough to flow through a screen placed in front. Mercury is fed in this battery, and the pulverized ore, mixed with sufficient water, is then made to flow over wide plates of copper fastened upon wooden platforms, and the copper amalgamated with quicksilver. The gold, or part of it, adheres, forming an amalgam with the mercury, which is afterwards scraped off, squeezed hard, and the lump retorted in a closed retort of iron for the purpose of vaporizing the mercury and getting the gold almost pure. The banks of Central buy these retorts and ship them to the East for minting. Each stamp is calculated to do from one half to three quarters of a tun in twenty-four hours, requiring about one horse power to each stamp head. Most of the ore is reduced in leased mills abandoned by companies, but there are several names famous for good results in custom work. These mill men charge their customers between three and four dollars per tun for doing this work and returning the retort of gold. The tailings are partially caught in the best mills on blankets, and reworked at a profit; the bulk, however, passes outside, a portion stopping to be shovelled into a pile, the balance going on to the stream. The waste is nearly or quite equal to the gross yield in bullion.

SMELTING FOR GOLD.

The most profitable branch of vein mining and reduction was undertaken by Professor Hill in 1867, in connection with some Boston and Providence capitalists, This is a close corporation, managed with rare ability in the executive as well as the metallurgical department. Large profits are made, but kept very jealously from the public eye. As you reach Black Hawk, the sulphurous vapors of these works arrest your attention. From the roadside, you see from twenty to thirty piles of ore, each vieing with the other in sending stifling vapors of sulphur into the atmosphere. These piles are first started on a layer of wood and are run up in a pyramid form some five or six feet, with a diameter at base from sixteen to twenty feet, and then fired, the sulphur affording the only fuel, after the exhaustion of the wood, to keep the fire going from four to six weeks. This ore has passed through the sampling works and been paid for, the amount lying thus in piles at one time amounting to, perhaps, $80,000. After roasting sufficiently to drive off sulphur and oxidize a portion of the iron, these piles are cooled and the ore carried to the smelting furnaces, where, under a heavy heat, more sulphur is driven off, and the silica or *gangue* matter is made to unite with the oxide of iron to form a slag. At the end of the smelting, some eight or ten tuns are thus reduced to one called "matte," containing from $1,500 to $2,000 in the precious metals, and from forty to sixty per cent of copper. This product is then shipped in bags to Swansea, England, for separation into the several metals contained. The establishment contains three smelting furnaces and three



THE COMBA SCURA BRIDGE—MONT CENIS RAILWAY.

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calcining furnaces, capable of reducing from twenty to twenty-five tuns of ore per day. The tailings, which are concentrated along the streams, and are also sold to this establishment, of which there are now on hand possibly 1,500 to 2,000 tuns, average from $35 to $40 per tun. These works are, doubtless, the most profitable of the kind known in the world. The field of Colorado has been open to them without competition since their start, and right shrewdly has the monopoly been maintained. As an evidence of success in treating the gold ores of Colorado it is pre-eminent, and in this respect a great step in the progress of mining industry.

New Method for Platinum Black.

I prefer taking platin-chloride of potassium, and were it not that rubidium and cæsium are too expensive, these would be even better, for their atomic weights are higher than that of the potassium, and consequently the particles of platinum are more widely separated. After the platin-chloride is completely reduced, the mass is treated with water to wash out the chlorides of the alkalies thoroughly, and the residue dried at a temperature not exceeding 220° Fahr., when it is ready for use. The operation can be readily conducted in a capsule of porcelain or platinum. The platin-chloride is introduced and covered with a circular piece of mica, a little smaller than the wide diameter of the capsule, with a hole in the center, through which the tube conducting the gas is introduced, The capsule is then heated by any convenient arrangement by which a temperature not exceeding 400° or 500° Fahr. can be maintained with a little management; a small Bunsen burner with a rosette can be used. If the temperature be too high, the platinum black will not be as good as that made at a lower temperature. Washing the platinum black, after the chloride is taken out, with a solution of caustic potash or soda and subsequently washing with distilled water may improve the product.—*American Chemist.*

Butter in Sacks.

The dairymen of Washington Territory, for want of tubs and jars, have adopted a method of putting up and keeping butter which presents some features that are worthy the attention of those having butter packed for family use or for retail trade. The packing is thus described by the *Illustrated Journal of Agriculture:*

"All butter is packed in muslin sacks, made in such form that the package, when complete, is a cylinder three or four inches in diameter and from half a foot to a foot in length. The butter goes from the churn, as soon as worked over, into the cylindrical bags, made of fine bleached muslin. The packages are then put into large casks, containing strong brine with a slight admixture of saltpeter, and, by means of weights, kept always below the surface. The cloth integument always protects the butter from any impurities that chance to come in contact with the package; and being always buried in brine it is protected it from the action of the air; and it has been ascertained by trial, that butter put up in this way will keep sweet longer than in any other way.

"Besides, it is found easier and cheaper for the manufacturer than to pack either in jars or firkins. And for the retailer there is no telling the advantage on the score of safety and convenience. These rolls of butter can lie upon his counter as safe from injury, from dust or other contact, as bars of lead; can be rolled up for his customer in a sheet of paper with as much propriety as a bundle of matches. If the consumer, when he gets home, discovers specks of dust upon the outside of the sack, he can throw it into a pail of pure cold water and take it out clean and white. As he uses the butter from day to day, with a sharp knife he cuts it off from the end of the roll in slices of thickness suited to his want, and peels off the cloth from the end of the slice, leaving it in tidy form to place upon the table.

HISTORY OF GAS LIGHT IN BRIEF.—In 1792, in England, Wm. Murdoch lighted his own dwelling with gas; in 1803, a machine shop, and in 1805, a cotton factory were similarly lighted. He began to lecture upon the subject, but not until 1810 could a company get a charter for its manufacture. In 1813, Westminster bridge was lighted, and in 1815, Guildhall. Still there was great opposition even from scientific men, and there were also great difficulties from want of machinery to make and use the gas. Gun barrels screwed together were used to convey it from place to place. Finally, however, every obstacle was surmounted, and now there is not a city of any size in the civilized world which is not lighted by gas.

COOKING FOOD BELOW 212° F.—From a series of experiments, it appears that food (meat as well as vegetables) boiled at 200° is more nutritious and of better flavor than when boiled at or above 212°. The author illustrates this point by what takes place in mountain localities (every 100 meters' rise above the sea level makes a difference of 0·6° less in the boiling point of water); as, for instance, at Potosi (Bolivia), at 4,061 meters above sea level, with an average barometer reading of 454 m.m., the water boils at 187°; at Mexico, 2,277 meters above sea level, 568 m.m. barometer, water boils at 198°; at Briançon (France), 1,321 meters above sea level, 643 m.m. barometer, at 184°; and he further cites the action of the so-called Norwegian cooking apparatus.—*Dr. Jeanel.*

THE great pyramid, which is seven hundred feet square and five hundred high, and weighs 12,760,000,000 tuns, required, according to Herodotus, the labor of 100,000 men for twenty years to build it; but Dr. Lardner affirmed that 480 tuns of coal with an engine and hoisting machine would have raised every stone to its position.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

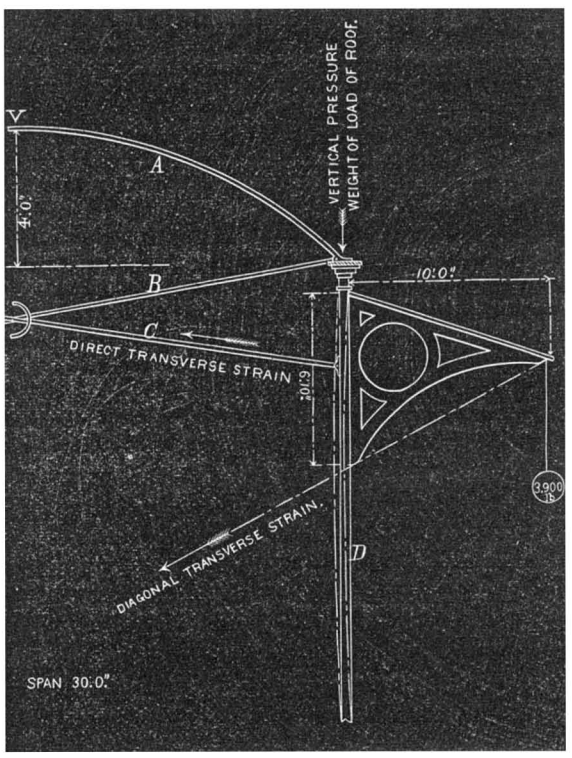
Fall of the Roof of the Depot, Saratoga Springs.

To the Editor of the Scientific American:

My attention has been directed to your issue of February 17th, in which you gave an account of the destruction, in December last, of the new passenger depot at Saratoga Springs.

The roof was arched, of thirty feet span, and made of corrugated iron, with wrought iron tie rods five eighths inch in diameter, and was supported by round columns four inches diameter, fifteen feet distant from centers. On the inside of each column, about five feet distant down from its top, was attached one end of a wrought iron tie rod, supporting the roof; and, on the opposite side, was a bracket, extending out ten feet, whose bottom exerted a diagonal transverse strain in the same direction as the tie rod. These brackets supported a roof, forming a shed over the gangway beyond the arched roof, making, with the thirty feet span of roof, an entire width of fifty feet. I was induced, after reading the article, to go into a calculation of the strains on the weakest part of this mantrap, namely, the columns and tie rods.

From the dimensions given, I take the diagram to be drawn on a scale of one sixteenth of an inch to the foot, and have made my calculations accordingly, The weight of snow and ice upon the roof, in accordance with the leading authorities, is considered at 40 lbs. per superficial foot as a maximum load in our climate. On the day of the falling of this structure, your article says, there had been a light fall of snow, and the ground was frozen. I question if the weight on the roof, at the time, exceeded 20 lbs. per foot, as snow is ordinarily light. What causes it to become heavy is a subsequent fall of rain, then freezing, and snow again. Forty pounds per foot is considered a maximum load under the most unfavorable circumstances.



The column was four inches in diameter, and, say, one inch in thickness, and about eighteen feet long, considering the diagram to be made on the scale of one sixteenth inch to the foot. Its proportion of vertical pressure would be the weight coming upon half the roof of thirty feet by fifteen feet distance from center to center of columns. Taking the weight of roof alone, exclusive of any contingent weight, at 12 lbs. per foot, we have 52 lbs. per foot for the weight of roof and load upon it.

15×15 feet=225 feet×52 lbs.=11,700 lbs. Weight of girder between columns, 15 feet, say, at 40 lbs. per square foot, =600 lbs. Total, 12,300 lbs., being a vertical load of 6·15 net tuns on columns.

The strain upon the tie rods, which was exerted transversely on the columns, about five feet down from the top, and tending to both break them across and pull them inward, was as follows: Let S=span in feet=30 feet; V=versed sine, say 4 feet; U=uniform load per foot span=780 lbs.; H=horizontal thrust or strain on tie. Then

$$H=\frac{US^2}{8V}=21{,}937 \text{ lbs., about 11 net tuns,}$$

which was an entirely uncalled for transverse strain on the column, and what caused the accident.

The weight on each bracket was: 10 feet out by 15 feet long=150 feet×52 lbs.=7,800 lbs.; one half weight on end of bracket=3,900 lbs, exerted at $\frac{10}{7}$=5,570 lbs., or 2¾ net tuns diagonal transverse strain on the column, acting in the same direction as that produced by the tie of the arch just above it.

The following is a summary of the strains on the column:

Vertical pressure, weight of roof, 6·15 net tuns; unnecessary transverse strain of tie to break the column across, 11 net tuns; diagonal transverse strain at the bottom of the bracket, in the same direction as that exerted by the tie, 2¾ net tuns.

Taking these spindle columns, whose dimensions are about suitable for a summer house or verandah, at a safe weight of one fifth the breaking weight, when subject to a vertical load and then only when the ends are at planes with their axes, we have the safe weight at $8\frac{8}{10}$ tuns. Nothing less than one fifth the breaking weight will do, as at one fourth the breaking weight it was found, by experiment, that incipient crushing took place. This safe weight allows nothing for a lateral blow caused by merchandise falling, in transmission, against the column. For a column where transverse strain is to be exerted, calculation should be made in accordance with the formula for strength of beams, as well as that for the columns.

In regard to the tie rods, they were not nearly up to the standard required for safety; a five eighths inch round rod is equal to about three tenths square inch of cross section. The working strain should not exceed the limit of its elasticity, which is about eight tuns per square inch. The Board of Trade of Great Britain permits, as a maximum working strain, but five gross tuns per square inch of cross section. In this case, the tie rods should have been at least one and a half inches in diameter to resist the thrust of the arch; and the columns seven inches in diameter, and one inch thick, providing the tie rod was not attached to it.

I would ask why it is that more stringent laws should not be enacted, whereby some restraint can be placed upon the construction of such insecure structures, equally so with the laws governing the construction and use of steam boilers? Here is a structure, every part of which, with the exception of the corrugated roofing, is largely deficient, imperiling the lives of hundreds of people under the trap daily.

PETER H. JACKSON,
Inspector of Iron Construction, Department of Buildings.
New York city, March 1, 1872.

Fall of the Roof of the Depot, Saratoga Springs.

To the Editor of the Scientific American:

In reading your number of February 17, in regard to the fall of the Saratoga depot, built of iron with corrugated roof, I was reminded of a paragraph in Achille Cazin's work on "Heat."

From the diagram in your paper, and the description of the case, it occurs to me that the columns, being vertical, were drawn inward by the contraction of the iron roof, aided by the iron cross bars. It seems that the weather was very cold, and there was snow on the roof. Now suppose that when the roof and iron bars were fitted to the vertical columns, the weather was warm, and the iron expanded to its greatest extent; the contraction by change of temperature to intense cold would be, in a distance of one hundred yards, 2½ inches. If the roof and rods of the depot were thus contracted, the vertical columns, having nothing to counteract this inward pressure and having the weight of an iron roof with snow upon them, canted, say two inches from the perpendicular. It occurs to me that these facts may account for the catastrophe at Saratoga.

"The laws of the dilatation of metals," says M. Achille Cazin, "deserve the more careful study seeing that iron especially is now so generally used for building purposes. A serious question might be raised, whether its universal employment is not in some degree censurable, and whether, in fact, our houses and public buildings are not exposed to accidents owing to simple change of temperature—so of iron bridges, so of metal roofs, gutters, etc. A chain of one hundred yards will vary 2½ inches in the course of the year," etc. (Page 145.)

Again, on page 143, Cazin says:

"A very curious application of the force of contraction of solids has been made by the architect Molard, on the building of the *Conservatoire des Arts et Métiers,* in Paris. The walls of a vaulted gallery had been pushed outwards by the weight of the superincumbent masonry, and it was feared the whole would fall. Molard arranged iron bars in a parallel direction, passing through the walls and carrying at both ends a screw thread fitted with screws. He heated the bars throughout their whole length, and having immediately screwed them up tight, allowed them to cool. The contraction of the iron, which proceeded slowly as it cooled, drew the walls nearer together without endangering them; and this was repeated at several trials, until the walls were re-established in a vertical position."

Suppose they had been so at first, would they not have caved in? R. B. M.

Utica, N. Y.

Tubal Cain.

To the Editor of the Scientific American:

In your issue No. 5, current volume, is a very interesting article, "The Antiquity of the Iron Manufacture." I venture to call your attention to an error therein in history.

Tubal Cain is spoken of as the half brother of Noah. In the fourth chapter of Genesis, it is shown that Tubal Cain was the seventh from Adam, through Cain; while Noah was the tenth from Adam, through Seth.

Pickereltown, Ohio. J. H. GREEN.

[Lamech is mentioned, in the chapter quoted by our correspondent, as the father of Tubal Cain, and he is also stated, in the fifth chapter of the same book, to be the father of Noah. There is no reason for our believing that there were two Lamechs. Probably the confusion arises from an inaccuracy in the translation.—EDS.

The Flexible Marble.

To the Editor of the Scientific American:

In your paper of the 17th, I noticed an article on the flexible stone in possession of Mr. Holliday of this city, and having examined the wonder, allow me to say that it is not itacolumite, which is a sandstone and belongs to the talcose series, but a very pure carbonate of lime, the crystals of which exhibit the usual variety of forms that, according to

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Dana, American marble should. The analysis gave but traces of impurities.

Under the microscope the exterior of the crystals was opaque, while the center was translucent and hard. I judged that there was partial calcination, either of the outside of each crystal or of the group of crystals, and perhaps that might account for the flexibility. Or, perhaps a part of the lime, rendered soluble by the calcining, was dissolved out while lying a year exposed to water almost constantly.

One thing is certain, that while the slab retains almost precisely the appearance of a piece of marble that has not endured such exposure, it is easily penetrated by a penknife blade to the depth of nearly half an inch. Considering the inutility of the thing, and the somewhat exaggerated accounts of its flexibility, I think ink enough has been shed over it.

E. E. WORTHEN.

Wheeling, W. Va.

[Professor James Orton, of Vassar College, states that a specimen of flexible marble was once in the cabinet of Williams College, about 6 feet by 8 inches wide. It is quite flexible for marble. It was soon broken by rough handling. He does not think a knife would penetrate it, as in this case. He conjectures that the Wheeling specimen owes its flexibility to a disintegrating process which has proceeded just far enough to allow some freedom of motion among the crystalline particles.—EDS.

[Reported for the Scientific American.]

SOCIETY OF ARTS OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

MEETING HELD AT THE INSTITUTE IN BOSTON, FEB. 8, 1872.

The President, J. D. Runkle, in the chair.

Mr. Edmund H. Hewins read a communication, well illustrated by photographs projected upon a screen by the calcium light, on European and American bridges, and compared the cost and methods of building bridges in the two countries.

It is now generally acknowledged that the "truss" is the form which admits of the greatest economy in the use of material; and yet there are some engineers who cling tenaciously to the old plate or box girder. A few years since an engineer of wide reputation and large experience condemned a truss bridge, giving as a reason that the peculiar construction would cause the iron to crystallize from the trotting of horses over it. The bridge was consequently built as a plate girder, and the cost was more than fifty per cent greater than it would have been for a truss bridge.

The days of tubulars, girders, etc., have substantially passed away; there will be no more Britannia or Victoria bridges; they stand as vast monuments of indomitable will and energy. All honor is due to Stephenson for building the bridge over the Menai Straits; considering the then limited knowledge of the use of iron in bridge building, it is a monument worthy to make his name famous for ages to come.

Brunel has done even more; the Saltash is a conception more gigantic, and as much a flight of genius—a work which will remain when the other is destroyed by time.

Truss and lattice bridges now predominate, the latter being but a form of the first.

THE BRIDGES OF EUROPE

are secured together by almost innumerable rivets; the various parts being usually composed of plate and angle iron riveted into box and other forms best calculated to resist the storms to which they may be subjected. The building of parts in this manner requires much care and is very expensive. The rivet holes deduct a considerable amount from the strength without reducing the weight.

A strut or tie composed of several pieces riveted together has not an effective strength proportioned to its section, for it is impossible to bring the different pieces to an equal strain at the same time. The engineer has here to make an allowance which is a very variable quantity. The ties and struts are rigidly connected with the chords.

Whenever a load comes upon a bridge, there must be some deflection; this causes a distortion of the form of each panel, and as the ties and struts are rigidly connected to the upper and lower members, a powerful leverage to bend them is the result, and there is at the same time an increased strain upon the rivets.

In the crossing of a railway train or other partial load, the counters, necessarily, not being in readiness to receive their proper strains at the proper moment, allow an undulation which materially increases the bending strains upon the ties and struts. This occurs every time a train or locomotive crosses the bridge.

The trusses used in American and European bridges are very similar; the essential difference being in details of construction, which in the European bridge are very expensive, as so much hand labor and fitting is required. A large amount of material is used which is mere dead weight, being of no use in sustaining the load or itself. The action of such a bridge is necessarily unsatisfactory from the fact that certain portions receive strains in practice which are not legitimate, and consequently must tend to shorten its life.

The following data were collected in Europe by Mr. David Buck. The viaduct of Fribourg, on the Orleans Railroad in France, is composed of eight spans of 160 feet each, and has a hight of 250 feet above mean low water of the Sarine The piers have a masonry foundation 89 feet high, with a metallic superstructure of 142 feet. The total length of the viaduct is 1299·88 feet, and cost, above the masonry, $366,000 in gold, or $282 per lineal foot. The figures for three other viaducts on the Orleans railroad are as follows:

THE VIADUCT OF THE BOUBLE.

6 spans of 164 feet each, total length	984 ft.
Hight above masonry, average	138·76 ft.
Cost per lineal foot	$167.00

THE VIADUCT OF BELLOU.

3 spans, average length 140 feet, total	420 ft.
Hight above masonry	137·76 ft.
Cost per lineal foot	$123.00

THE VIADUCT OF NEUVILLE.

2 spans of 161·13 feet each, total length	322·26 ft.
Hight above masonry	136·18 ft.
Cost per lineal foot	$112.00
1 span	77·08 ft.
Cost per lineal foot	$108.00

THE AMERICAN TRUSS BRIDGE,

instead of being bound together in one solid mass, is composed of various members, each independent of its neighbor, so far as its own work is concerned, each having a specific and defined duty to perform, and proportioned accordingly. By no change of temperature, or variety of load in amount or position, can any but legitimate strains be imposed upon any part. The joints are made with pin connections so that a deflection can bring no twisting or bending strain upon any of the parts—and though the form of each panel be very much distorted by an approximation to the breaking load, no excess over the proper strain can be brought to bear on the bridge. Each part is known to receive its proper strain at the proper time, as they are made adjustable in all directions, and by this means the vibration and undulation are reduced to a minimum. American bridges have astonished the world that such light structures should have so little deflection and undulation.

American bridges are cheap to build. Most of the work is done by machinery instead of hand labor, and but little skilled labor is required.

Work done by machinery does not cost one half as much per pound as work done by hand. Considerable expense is also saved in handling and erection.

It is sometimes necessary to erect bridges over streams which are liable to rise suddenly and sweep away the temporary works. In such a case, the loss would be incalculable in time and money, if the bridge should be carried away.

Our bridges—built as they are in parts which are seldom too heavy for two or three men to handle—can be erected in a very short time.

A 200 feet span could be swung clear of the staging in three or four days, while the plate girder, lattice, or European truss would require as many weeks. The average cost of railroad bridges in America is about one half as much in currency as European bridges cost in gold.

ANCIENT BRIDGES.

Professor Watson made a few remarks concerning ancient bridges.

The Sublicius Bridge across the Tiber at Rome was the first of which we have drawings and descriptions. It was built B. C. 616, and was of wood. It was replaced by a stone bridge and this subsequently by a marble bridge.

The Senator's bridge, now called Ponte Rotto, was built by Scipio in the year 127 B. C., and reconstructed by Gregory XIII in 1575.

The bridge of Trajan across the Danube, built in 104 A. D., had piers of stone with a wooden superstructure.

The bridge over the Elbe at Dresden has eighteen arches of sixty-three feet span. It was built in the year 1200 and restored in 1731.

Michael Angelo built the Rialto at Venice in 1578. The order of "*Frères Pontifes*" was instituted in 1189, for the purpose of building bridges in Italy and France. This order existed for about five centuries.

"MINERAL WOOL."

Professor Pickering exhibited two novelties he had received from Dr. Wm. Wahl, of Philadelphia. The first is a white fibrous substance, resembling asbestos, which is made by forcing high pressure steam through melted slag.

This mineral wool, as it is called, is a good non conductor of heat and is, of course, incombustible. It seems well adapted for steam packing and a variety of uses. The second novelty was a plate of glass on which an engraving has been made by the sand blast. A photograph was first taken on the glass, which was then covered with a film of gelatin and bichromate of potash, and exposed to the light. The light renders the film insoluble; and after washing off the portion unacted on by the light, the plate is ready to be subjected to the sand blast; the remaining insoluble portion of the film protects the parts of the glass which it is not desirable to cut.

He then made a few remarks about the various methods of photographic engraving.

With the earlier processes, it is necessary that the printing be done on a lithographic press and that the object be entirely in black and white.

The New York Lithographing and Engraving Company have succeeded in printing the photographs on a common printing press. To do this, it is necessary that the dark portions of the photographs should be raised above the white. This object is secured by means of the film of gelatin and bichromate of potash, as above described.

Specimens of Woodburytypes, Albertypes, heliotypes and autotypes were exhibited, and their peculiarities and different applications pointed out.

Mr. Markoe showed an improved achromatic stereoscope, made by Mr. Beck, of London. It admits of the use of opaque or transparent objects, and can be readily adjusted to suit the focal distances of both eyes, in case they should differ.

W. O. C.

Changing Clothing---Pneumonia.

Pneumonia has prevailed in this city during the past month, to unusual extent and many of our well known business men have fallen a prey to the disease. Our physicians say that they have never before known the disease so difficult to treat successfully. The following from *Hall's Journal of Health* for March is timely and worthy of consideration by all.

In the latitudes of New England and New York, going westward, the month of March is the most disagreeable of the whole year, with its changing temperature, its slosh and mud, its cold, raw, piercing, damp winds; and although not as cold as January and February, it is more prolific of dangerous diseases, greatly promoted by the hurry of the people for lighter clothing; but it would be a great deal better to wear the entire winter suits through March, and even to the middle of April; and even then, until the first week in May, to make no change in the outer clothing, nor any in the inner garments, except to a less heavy woolen next the skin; for it is only for the three hours embracing one o'clock in the afternoon that winter clothing is at all oppressive; while the very warmth of noonday makes the raw dampness of the morning and late afternoons specially felt.

All changes to a lighter or cooler garment should be made at dressing in the morning; and if in any case the change leaves the body chilly, or if soon after it is made the weather changes to be much cooler, by all means promptly, without half an hour's delay, resume the full winter dress. The old, the young, the invalid, in short all persons of feeble constitutions of small vitality, should be especially careful to heed these suggestions; inattention to which gives rise to the very frequent announcements in the morning papers, in the early spring: "Died suddenly, yesterday,———, of pneumonia,"—often, the very friend whom we had met in the street, or at church, within a week, apparently as well and as hearty as ever before.

Softening Frozen Ground for Excavating.

This invention has for its object to reduce the expense of digging the ground during the winter season for building or other purposes; and consists in the application of steam to frozen ground for the purpose stated. At present, with frozen ground, the digging in winter is very expensive and difficult, and consequently the preparation for a commencement of building during the cold season is not generally undertaken on account of the greater expense. The hands are, therefore, mostly idle in winter. All this will be, it is claimed, avoided and a flourishing trade continued throughout the year by the introduction of an inexpensive system of softening the frozen ground.

The inventor, Mr. Andrew Derrom, of Paterson, N. J., claims to have ascertained that a small jet of steam applied underground will take the frost out of a disproportionately large extent of earth. He practically utilizes the discovery by applying steam, under pressure from a boiler or steam generator, which is conveyed under the earth in a suitable pipe. As it is forced cut of the pipe, it interpenetrates the particles of earth, is condensed, parts with its latent heat, and is asserted to thaw an astonishing space of ground in proportion to the quantity of steam employed.

Postal Telegraphy.

In England, all the telegraph lines are now owned by the government, and short messages may be sent to any part of the kingdom for twenty-five cents. The government issues what are called postal telegraph cards, bearing a twenty-five cent postal stamp. On this card you write your telegraph message, and drop it in the lamp post letter box. The letter carrier delivers it to the telegraph department, and the message is promptly forwarded to its destination. The English Government has been petitioned to purchase all the submarine telegraph cables leading from England.

A Queer Case.

Dr. H. Vogel, writing from Germany to the Philadelphia *Photographer*, relates a queer case. A photographer made pictures of two brothers, who refused to take or pay for them on the ground that they were not likenesses. The artist complained, but the judge was of the same opinion as the brothers, and decided that the pictures were not likenesses. Mr. Photographer then went home with his rejected pictures and placed them in his show window, with the label, "The murderers of Mrs. X." The brothers then waited on the artist and alleged that it was a libel to expose their pictures with such a title, and, on his refusal to remove the placard, they entered suit. It remains to be seen how the judge will decide in this new phase of the affair.

PEARLS.—Mr. R. Garner lately read a paper before the Linnean Society, London, in which he referred to the theory, now generally adopted, that the production of pearls in oysters and other mollusks is caused by the irritation produced by the attacks of the minute parasite known as *Distoma*, and believed that, by artificial means, this parasite might be greatly increased. British pearls are obtained mostly from species of *Unio*, *Anodon*, and *Mytilis*, but it is probable that all mollusks, whether bivalve or univalve, with a nacreous lining to the shell, might be made to produce pearls.

MR. JOSEPH B. SYKES, of West Hartford, Mo., writes to inform us that large and severe sores on his legs have been cured by the use of a remedy prepared according to the following prescription: To 1 pint sweet milk, a heaped teaspoonful pulverized alum is adding while stirring, the milk being at a temperature high enough to curdle it. The whey is poured off, and the curd is applied to the sore. The sores arose from accidental bruises and abrasions, and had been troubling our correspondent for many years.

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THE LOWELL WATER WHEEL TESTS.

Some of the water wheel manufacturers, whose wheels have been tested at Lowell, have expressed dissatisfaction at the table of results, furnished by Mr. Risdon, published in our issue of February 24. In the hope of satisfying all parties we append herewith a tabulated statement, furnished by Mr. Emerson, which he asserts to be correct. In the report from which this table is taken, the writer states that the Risdon wheel was bound slightly in the upper bearing, at Lowell, causing a loss of perhaps one per cent, while it ran perfectly free at Mount Holly, where it gave 84·60 as the highest result. It will be seen, by referring to the table previously published, that the latter was included under the Lowell tests; but it seems the result was obtained at another time and in another place.

NAME.	Size.	REMARKS.	Ft. Head.	PERCENTAGE OF PART GATE. ¼	½	⅝	¾	⅞	WHOLE GATE. H. Power	Per cent.
Swain	42 in.	In quarter turn	14.25						63.00	82.2
"	36	" " "	15.10						46.39	77.56
"	36	Wood flume	15.10	13.10	43.20		67.00	71.90	45.40	74.60
"	30	" "	15.41		47.30	59.20	59.20	72.80	36.40	76.17
"	24	Quarter turn	16.66		54.17		72.30		24.26	77.69
"	24	Wood flume	15.89		55.40		67.60	72.90	18.07	72.60
Leffel	40	Iron case, extra finish, expressly for test							42.00	79.70
Common finish.	30½	Wood flume	15.40		59.10	64.80	66.40	67.50	31.82	74.30
Bodine Jonval.	35	Iron case	14.70						34.00	75.90
Bryson turret.	42	Wood flume	14.00							75.14
" "	30	Iron case	14.51						26.00	74.10
Tice	30	Wood flume								
Houston	30	" "	8.50						11.25	82.30
"	35	" "	15.50						41.28	79.94
Second	35	Iron case. Ice in flume and on weir	14.55						37.36	77.50
"	30	" " " "	15.80						26.81	78.80
Third	30	Wood flume	15.00		45.50	48.60	60.90	65.00	29.45	81.20
"	30	With four guides stopped with blocks of wood							22.72	76.00
"	30	With seven, or one half, the openings stopped, discharging a little more than half water							5.76	70.30
Trullinger	30	Brass buckets, bound in curb and burst	15.69						19.31	50.64
Second	30	Iron buckets. No reliable part gate	15.80						27.78	70.37
Kindleberger	25		15.80						25.22	62.46
Stetson	30	Open flume—1870	15.79				71.60		25.72	78.46
"	30	In decked flume—1871	15.09		56.84		72.83		26.13	79.26
Second	30	Deeper, greater discharge	16.17						29.32	74.10
Same	30	Suspended by the neck	16.07		55.76		70.36		27.17	75.70
Another	30	Like the above, with one bucket less	16.00		55.41		71.79		29.61	77.40
Same	30	Suspended by the neck	4.76						26.81	79.08
Upham	36	Wood flume. Bound in curb and crumbled to pieces	15.99						18.32	52.08
Second	36	" " Same curb bound badly	15.59						22.06	58.82
"	36	Scroll	15.85						26.53	72.84
Third	36	Wood flume. Bound in curb	15.64						17.11	53.78
Fourth	36	" " Less No. of buckets than the above	16.52						18.96	60.03
Fifth	36	Scroll. Scroll 1¼ in. in depth less than the above	16.38						20.05	64.09
Sixth	36	Less buckets. The 4 wheels made with plates at top	16.38						20.05	64.09
Seventh	36	1st scroll wheel made with arms, openings between, tested in reduced scroll	16.31						22.28	67.42
Luther	30	Scroll wheel	16.10						18.91	70.51
"	16	Discharged so little water that it would not carry brake								
Wheeler	36		15.65				66.90		27.73	74.50
Second	36		16.10		61.56		70.62		29.63	74.46
Third	36		15.61						25.56	67.61
Whitney	30		15.28						23.48	67.13
Second	30	Greater discharge	5.71						23.79	
Third	30	Three less buckets. Results better than with more	15.66						27.07	
"	18	Sliding gates	15.15						11.70	
Wynkoop	42		15.12						36.22	55.89
"	42	Cut hole in draft tube. Large quantity of water escaped unmeasured	10.90						21.88	62.60
Davis	36	See his patent curb. Wheel burst after running a few minutes	16.30						30.97	66.90
Second	36	Curb tried for part gate tests, but nothing seemed gained by the arrangement	15.17						36.42	68.56
Third	36	Like the Warren	15.48						33.30	63.46
Tyler	42	In use six years	15.20						34.90	55.56
"	30	New, none sold	15.70		38.11		59.08		27.13	73.83
Second	30	Old style, wrought iron buckets	15.69						25.91	67.04
Third	30	Old style, cast whole, cast iron buckets	15.53						25.66	67.01
Burnham	24		15.40		48.16		64.63	71.95	19.71	77.09
"	36¾	Tested with rigid shaft	15.27		45.60	54.60		71.00	42.18	78.60
"	36¾	Clutch couplings used	15.57						43.27	78.50
"	36¾	Rigid couplings. Buckets and shaft filed	15.42						43.27	79.20
Buzby	36		14.97	15.92	43.08		58.51	63.25	24.40	66.13
Cook	30	Buckets changeable	15.70		56.78		67.92		27.53	73.11
Second	30	Double buckets	14.71		66.10		74.90	78.20	28.14	72.40
Bastion	30	Intended to be like Houston's	16.25		26.51		48.30		18.04	66.75
Second	30	Wicket gate	16.10				31.40		27.64	69.70
Third	30	" "	16.06		9.35		34.60		24.67	70.10
Risdon	30	With diffuser on. Diffuser was a flaring tube underneath	15.79						27.53	77.09
"	30	Diffuser off	15.98		37.41		66.59		27.42	77.14
"	36		15.92		41.17	58.08	69.02		36.57	78.71
Eclipse	24	Experimental to determine effect of changes								
Barber	30	Combination—two wheels—test of upper wheel alone	15.97						24.78	66.36
"	30	Test of the two combined	15.03						26.36	68.43
Teller	30	Double wheel	14.78						27.27	64.50
"	24	" "	16.11						20.64	53.80
Libby	30	An inverted Houston's	15.36		11.50		41.42	48.88	25.78	75.61
Second	30		15.94						21.05	64.80
Third	30		15.42						27.13	77.80
Gardiner Cox	30	Double—Spiral and Jonval	14.87		45.90		64.30	69.50	20.11	70.00
Thompson	30	Somewhat like Houston's	15.87		53.90		68.90	69.10	21.50	72.00

City Disinfection.

The excreta of man and animals contain all the mineral matters formerly contained in their food. It is, therefore, obvious and most natural, yet more, an absolute necessity, to return these excreta to the soil. Fresh feces contain an average of twenty-five per cent of solid matter and seventy-five per cent of water. The mineral matters consist of one third of phosphoric acid. Dried feces are, of course, much richer on account of having lost the water. A city of one hundred thousand inhabitants would yield per year 1,300 tuns dried feces, containing 112,000 lbs. of phosphoric acid.

Professor Liebig says: "The coming generation will consider those men as the greatest benefactors of mankind who devote all their efforts to utilize and save the night soil of the cities." Poudrette works have been established in the United States, Germany, France, and England, but none have ever yet united the sanitary with the agricultural interests. Some trials have been made to employ iron salts for disinfecting the night soil, but such a poudrette is almost valueless. Other trials were made with lime, which only caused the loss of the ammonia, and had no disinfecting value whatever. Dr. Julius E. Dotch, of Washington, D. C., has patented a method for such disinfection, which appears to be of value. It consists in the application of a prepared earth, containing clay, sulphuric acid, and nitric acid, which is spread in thin layers over the fresh feces.

By this means, not only is the formation of fungoid growth effectually prevented, but also all the ammonia is taken up on account of the sulphuric acid; and the sulphuretted hydrogen developed from the feces will be entirely destroyed by the nitric acid present in the patent earth.

A Lecture on Rattlesnakes.

Two miles out on our road back, we found Straddlebug sitting like a statue, gazing at something in the road just ahead of him. "Come here, General Bradley," he called, "I want to introduce you to one of the inhabitants of this delightful country," at the same time pointing to a monster rattlesnake coiled in the trail. "I have been plaguing him," continued old Straddle, "and he is a game fellow. See," he added, holding out his sabre toward the reptile. Quickly the snake raised his chest and sprang his full length, falling within two feet of the legs of old Straddle's horse. "Look out there, or he'll bite you," cried General Bradley. "Not a bit of it," replied Straddle. "The fact is, General, I have been studying this specimen of the natural productions of this country for more than an hour; and I have found out, first, that he will not bite unless coiled; second, that he can only jump the length of himself when coiled." He then made the snake coil up again and strike two or three times. "He ain't much of a traveller, either," said old Straddle, whipping the reptile when stretched out and making it run as fast as it could. "He coils tail first," continued the experimenter, making him coil, "and like an honest fellow, gives fair warning before he strikes, which is more than some of our own kind do, General; besides, I don't believe he'd strike in the dark at all. You will readily observe," continued old Straddle, growing facetious, "the difference between the nature of the snake and the dog; a dog shakes his tail to show you he is pleased; the snake shakes his tail to show you he is mad. Look at that eye, sir; I have looked a mutineer in the eye and disarmed him; but I would not like to look at that fellow steadily in the face for the space of five seconds." The snake was coiled, his body resting on his tail, and his head raised to the hight of a foot, and his neck proudly curved. His eyes shone like two little diamonds, and his yellow skin glistened in the sun. The spots on his back seemed ever changing from dark brown to a bright red copper color. "Come," said old Straddle, "I'll bet there's not a man in the crowd can shoot him in the head." (It is said to be almost impossible to shoot the head off a rattlesnake. The hunters declare that their sensitiveness is so great that they can feel the wind of a coming bullet, and dodge it. Be this as it may, I have seen men who could hit a bull's eye or drive a nail at one hundred yards that could not shoot a snake in the head.) Several revolvers were levelled and discharged at him, but the snake remained unharmed. A soldier then dismounted, and taking a carbine, at the fourth shot nearly severed the body of the reptile. "Foul!" cried out Straddle; "you hit him in the body; but take off the rattles, the game is yours." The man did as he was bid, and there were eleven rattles and a button.—*Letter from the Plains to the Philadelphia Press.*

MANUFACTURE OF THE SULPHATES OF SODA AND POTASH, AND CHLORINE.—Henry Deacon, of Warrington, Eng., has recently patented in this country a process of manufacturing sulphate of soda and sulphate of potash and chlorine, by causing heated sulphurous or sulphuric acids, mixed with air or oxygen and with or without vapor of water, to pass in succeeding alternations over, through, or in contact with certain chemical substances called catalytic, and over, through or in contact with the alkaline chlorides, common salt, or chloride of potassium, which alkaline chlorides are kept separate from the said catalytic substances or may be easily separated therefrom by mechanical means.

Velocity of Meteoric Stones.

In Professor Nordenskjold's account of the aerolitic shower which took place near Hessle, in Sweden, on the 1st of January, 1869, he mentions as a remarkable fact that stones weighing two pounds, which struck the ice of the Larsta-Viken, failed to penetrate, making holes only three or four inches deep in the ice and rebounding.

The small velocity retained by these stones, at the time of striking the earth is, doubtless, owing to the resistance of the air, and, consequently, is not an indication of the velocity which they had upon entering the atmosphere.—*Nature.*

The interest of the above, says the *American Gas Light Journal*, lies in the fact that many meteorites have been proved to pass into the atmosphere with a swiftness more than ten thousand times greater than that of the swiftest cannon ball. The flame that attends their passage is believed to be due to heat produced by their compression of the air in front, as in the "fire syringe." The writer has before suggested that, if a cannon ball could be projected with this velocity, it would burn up instantly as a streak of intensely brilliant flame. The probability is that the impulse necessary, however, to impart such a velocity to a cannon ball would grind it to powder in overcoming its inertia. We have also before thrown out the idea that aerolites which reach the earth are such as have had their velocity so reduced by friction that they become cooled below the vaporizing point before reaching the earth. The comparatively low velocities above recorded are thus easily understood. Much must depend on the angle at which they first strike the atmosphere. Some think that, in meteoric showers, they merely flame through the outer edge of the atmosphere, and shoot on in their appointed paths, like messengers from the outer universe who merely call to take a look at the earth in passing; but it may be, on the other hand, that these "falling stars" are altogether consumed or dissipated, reaching us only as impalpable dust.

Copper Gas Pipes.

The *Journal de l'Eclairage* notices an accident which once more proves the danger of using copper gas pipes. On the 21st of April last, a workman having, with a triangular file, cut almost through half the diameter of a gas pipe of red copper of ⅝ in. interior diameter, which supplied the Liége station, was removing the tool when an explosion similar to the report of a rifle ensued, and the workman was much burnt.

A similar incident happened the other day, with less intensity, however; and the workman, who was not injured, did not report the circumstance. Some gas pipes having been taken down, they were found covered with a blackish coating, and they showed evident signs of corrosion from ammoniacal condensation.

The black matter was analyzed, and was found to consist of an acetate of copper, which exploded between 203 and 248 degrees, producing water, copper, carbon, carbonic acid, and traces of carbonic oxide.

Coating Cast Iron with other Metals.

We are constantly receiving queries requesting information in regard to tinning, zincing, and coppering small iron articles. While we have often answered these by details of processes that we have found to answer, and which our readers have contributed to our column of answers, it is evident that there are various practical difficulties which arise to defeat success in many cases. If our correspondents who have had the requisite experience can give directions how to escape these stumbling blocks, the information will be gladly received by many readers.

SWEETENED FUEL.—During a recent passage of the steamer *Morro Castle* from the West Indies to New York, a fearful storm was encountered, which lasted four days. The coal fuel became short and, it appearing evident to Captain Curtis that if the engine stopped the vessel would be lost, he ordered the firemen to make use of sugar in the fires. Chairs and other furniture were also broken up and burned. Mixed with coal and wood, the sugar proved to be a good heating material, and by its use the ship was saved. Ten thousand dollars worth of crude sugar was consumed.

AN American engineer, now engaged in the construction of the Arequipa and Puno railway in Peru, a railway which twists about among the Andes, gives the following items: This road is to be 220 miles long, its highest grade line will be 14,600 above the sea; its terminus at Puno is on the shore of Lake Titica. The gage is 4 feet 8½ inches. The steepest grades are 211 feet to the mile, curves 16 degrees. From Arequipa to the Pacific coast, 100 miles, a railway is now in operation.

MR. G. D. HAMILL writes to say that, in our article on Japanese native steel on page 136, current volume, speaking of him as having the position of superintendent of the Imperial arsenal at Tientsin, we were in error. Mr. Hamill is the foreman of the machine shop department of the arsenal.

THE iron plates intended to protect the turrets of the great war ship *Devastation*, which is being built at Portsmouth, Eng., each weigh twenty-four tuns and measure twenty feet in length, nine feet in breadth, and eight inches in thickness.

A DOUBLE line of telegraph is at present being constructed across the Andes. Thirty miles of this line, which will pass over the snow covered cordilleras, will be constructed of two copper sheathed cables. It is expected that the line will be completed early this spring.

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Combined Scissors, Button Hole Cutter, and Tracer.

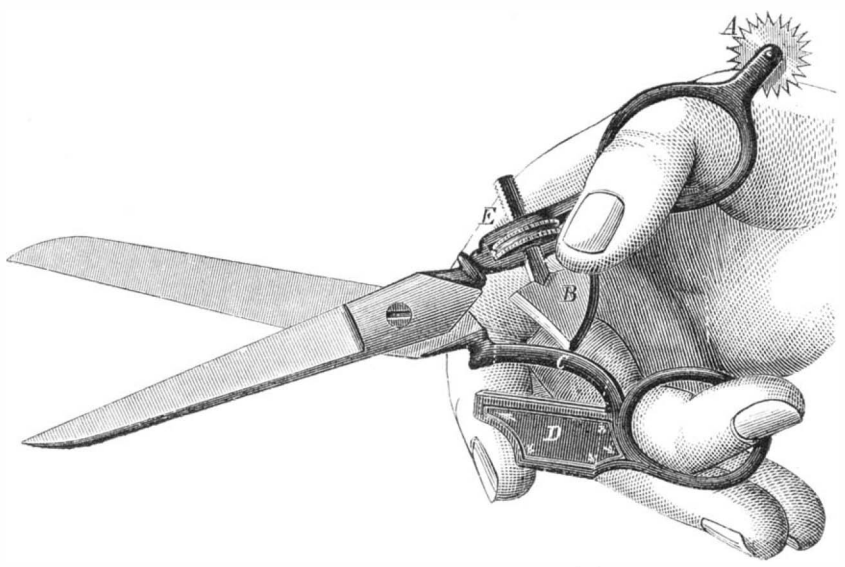
Our engraving illustrates a very simple, and, we think, useful combination of tools to form a single implement, which adds much to the convenience of the ordinary scissors, while it but very slightly increases their cost.

It is, as our heading implies, a combined scissors, button hole cutter, and tracer for patterns, the operation of which will be readily understood, from the engraving, by our lady readers.

The tracer, A, is a toothed marking wheel pivoted to the thumb piece of the scissors. The button hole cutter is a pointed blade, B, which is fastened to the upper branch of the scissors, and which plays through a slot in the lower branch, at C, and passes into a slot in a metallic sheath, D. The edge, of the cloth in which it is desired to cut the button holes, is supported by this sheath, and the size of the holes is regulated by the thumb nut, E, which, turning in a slot in the upper branch and working on a thread cut upon the shank of the buttonhole cutter, raises it or lowers it, so that it passes more or less into the sheath as the branches of the scissors are brought together.

The button holes are thus cut with great facility and accuracy.

Patented by E. A. Franklin, through the Scientific American Patent Agency, February 27, 1872. Address the patentee, as above, or B. R. Franklin (till the 15th of March), at the Merchants' Hotel, Courtlandt street, New York. The latter wishes to negotiate with manufacturers for making the article, or will dispose of rights.



COMBINED SCISSORS, BUTTON HOLE CUTTER, AND TRACER.

A Model Railway Foundery.

The Aurora *Beacon* says that the new foundery of the Chicago, Burlington & Quincy Railway Company, in Aurora, Ill., is 180 by 190 feet. One wing is reserved exclusively for casting car wheels. The cupola which supplies the molten iron for this purpose is of the capacity of seventeen tuns, and the full force is enabled to turn out sixty car wheels per day. This floor is supplied with four monster cranes, which pick up the wheels from the flasks while still at a red heat, and, passing them along from one to the other, convey them to the annealing room. Here are twelve immense pits, of great depth and walled with brick, into which the wheels are lowered one by one to undergo the annealing process. Nearly the entire eastern floor is appropriated to general casting purposes, supplied with another cupola, of the same dimensions and mammoth cranes for handling the ponderous castings produced. Another wing contains the carpenter shop for the repair of patterns, flasks, etc., and the cleaning room, which is furnished with two immense "tumblers" to facilitate that operation. The engine room, in charge of Mr. Keyes, is a model of order and neatness. The machinery of this room was put up under the direct supervision of C. F. Jauriet, Esq., Superintendent of Machinery of the road, and Mr. Prindle, Master Mechanic, a sufficient guarantee that the nearest possible approach to perfection has been attained. All the iron and coal is elevated to the furnaces by steam, instead of the old system of tramways; and one of the celebrated Root blowers furnishes the blast for the cupolas. So perfect is the working of every portion of the machinery that with the eyes averted one will fail to detect the slightest noise, or to dream that a powerful engine, massive wheels, and numerous pulleys are in full operation within a few feet of him.

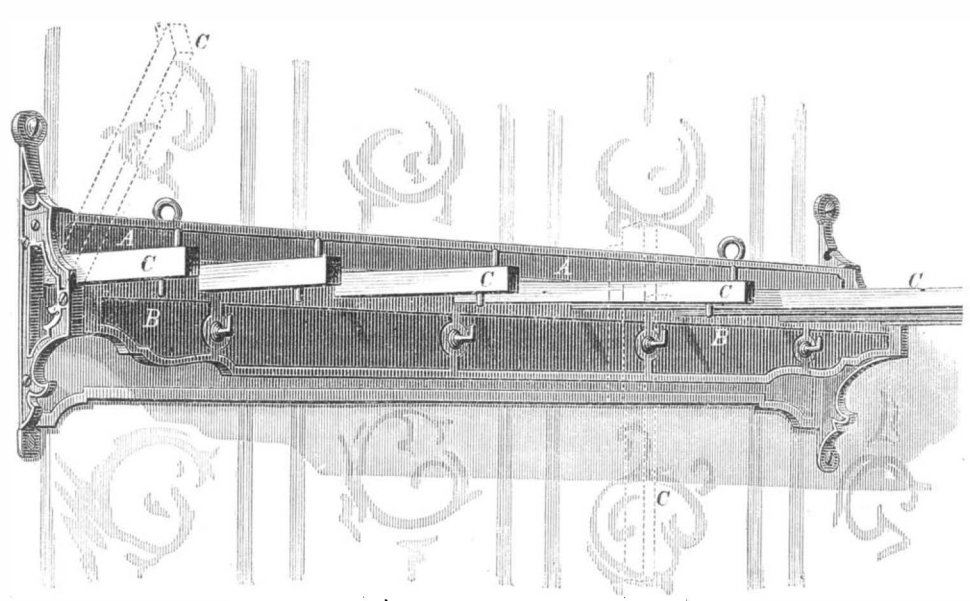
Improved Clothes Rack.

The clothes rack shown in the accompanying engraving is a very neat and handy device, cheap, and easily applied to use. It occupies no floor space, and when not in use can be arranged to occupy but very little space on the wall to which it is attached.

A wall piece is constructed of a back rail, A, and a front one, B. The back rail, A, has a projecting flange, under which the rear ends of the clothes bars, C, bear while they rest in notches cut in the front rail, as shown. The clothes bars have each a short dowel pin extending upward from the rear end, which engages with a hole bored partly through the projecting flange of the rail, A. This prevents their swinging laterally. At the front end of each clothes bar there are two pins placed at a suitable distance from each other, on opposite sides of the bar. The bars, when not in use, may be taken out and, by the two pins described, may be suspended vertically from the wall piece.

The rack, as a whole, may be suspended in any suitable manner from the wall.

Patented, December 19, 1871, by J. & D. Miller, of Marietta, Ohio. For further particulars, address them as above.



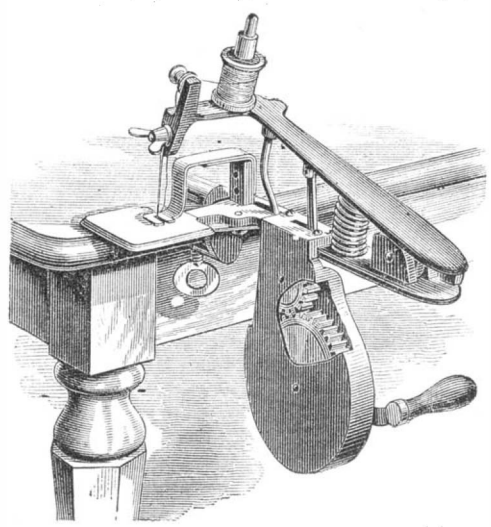
MILLER'S IMPROVED CLOTHES RACK.

Expert Testimony.

There was a fresh example of the worthlessness of expert testimony during a recent trial for forgery at Taunton. A couple of experts disposed of the prisoner at the bar very summarily. When Mr. Henry D. Hyde, of Boston, his counsel, handed the smartest expert four old envelopes and asked him if he could tell whose handwriting was on them, the witness, after taking time to examine them, said that "the superscriptions on the envelopes were all in the same handwriting, and all written by the man who forged the check." Mr. Hyde at once took the stand, and taking the envelopes, said, "This one was written by the clerk of the Boston Water Power Company, this one by a friend of mine in New York, the third is my own hand writing, and the fourth is the prisoner's," substantiating his statement by producing the letters received in some of the envelopes.—*Springfield Republican.*

THE BECKWITH IMPROVED SEWING MACHINE.

Our readers will remember our illustration of a ten dollar sewing machine, published on page 70, current volume. They will also recollect that the needle, in the machine referred to, was carried by a bar, the downward motion of which was produced by the hand through the agency of a wire and thumb-ring, while the upward movement was made by a coiled spring. This arrangement, while it answered the purpose very well, had two defects; first, that it required some practice to acquire the motion of the wrist, necessary to impel the machine properly and make it do uniform work, and secondly, that the speed was limited to the speed at which it is possible to move the wrist with regularity and without fatigue.



Both these defects are removed by the improvement herewith illustrated, which consists in the attachment of a strong toothed wheel impelled by a winch, which wheel meshes into an equally substantial pinion, the pinion being also a crank wheel connected to the needle arm by a short pitman. This gearing is protected by a shield, so that neither the cloth nor the dress of the operator can get caught in it. A spring is used merely to balance the weight of the bar and render the power necessary to be applied to the winch more uniform. The speed of the needle is by this means more than doubled, with an expenditure of less labor than before, the exertion required to move the fore arm in the former machine being the principal source of the expenditure of power. A much slower motion of the wrist—while the fore arm is comparatively motionless—now produces more than double the useful effect, and greatly increases the utility of the machine.

No change has been made in the feed, or in the stitch (loop stitch) and the cost of the machine is not increased by the improvement. We have never seen a sewing machine that will work with so little expenditure of power as this. It is self feeding, the stitch may be made long or short, it will hem and tuck, and it sews with facility through a number of thicknesses of muslin.

For further particulars, address W. S. Barlow, President Beckwith Sewing Machine Co., 26 West Broadway, New York.

Power of the Waves.

The tremendous force of the sea was exemplified on a recent passage of the steamship *Helvetia*, from London to New York. At midnight a mountainous wave struck the ship from the starboard side. The captain at the time was standing on the bridge giving orders. The wave caught him with full force, and would have washed him into the sea had he not grasped a funnel stay. After the wave had passed, the captain found himself dangling in mid air, twenty feet from the deck. He held on until rescued. The storm continued with relentless fury for six days, when another monstrous wave was shipped. It carried away two life boats, made a complete wreck of the larboard side of the bridge, destroyed all the ventilators on deck, and tore a hole eight feet in length by two feet in breadth in the smoke stack. Through the aperture thus made, an avalanche of water was precipitated into the engine room. The fires were all extinguished, and for two hours the vessel lay helplessly battling with the waves. After almost superhuman efforts, the rent in the funnel was patched up, the fires were again kindled, and the engines resumed operations.

Durable Sensitive Paper in Photography.

Sensitized albumen paper may be preserved good and white for many days, if placed between heavy paper—that used for copperplate printing—provided the paper is first saturated with a solution (1 to 5) of carbonate of soda, and dried.

Another method, highly spoken of and long practiced by Dr. Vogel, is to wash the paper after sensitizing. This paper requires ammonia fuming when used.

The same author states that paper sensitized in a bath composed of 12 parts of water, 1 part of nitrate of silver, and 1 part of citric acid, keeps perfectly white for six weeks, will print as rapidly as ordinary silvered paper, and requires no fuming.

In the last volume of the SCIENTIFIC AMERICAN, we published a formula for citric acid paper, as presented to the Berlin Photographic Society, consisting of 6 ounces of water and 1 ounce each of nitrate of silver and citric acid. One of our correspondents who tried the formula stated that it gave him red pictures, and that discouraged him from its further use.

Traveling Stones.

Many of our readers have doubtless heard of the famous traveling stone of Australia. Similar curiosities have recently been found in Nevada, which are described as almost perfectly round, the majority of them as large as a walnut, and of an irony nature. When distributed about upon the floor, table, or other level surface, within two or three feet of each other, they immediately began traveling toward a common center, and there huddled up in a bunch like a lot of eggs in a nest. A single stone, removed to the distance of three and a half feet, upon being released, at once started off, with wonderful and somewhat comical celerity, to join its fellows; taken away four or five feet, it remained motionless. They are found in a region that is comparatively level, and is nothing but bare rock. Scattered over this barren region are little basins, from a foot to a rod in diameter, and it is in the bottom of these that the rolling stones are found. They are from the size of a pea to five or six inches in diameter. The cause of these stones rolling together is doubtless to be found in the material of which they are composed, which appears to be loadstone or magnetic iron ore "Rolling stones gather no moss."

GREAT BRITAIN uses 20,000,000 tuns of coal per annum for power, and thereby adds an equivalent of 133,000,000 of working men to her population without having to feed or clothe them or care for their families.

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SCIENCE IN THE COURTS.

As science has advanced, it has become an important aid in the discovery of crime. The experts, so called, whose examinations, investigations, and opinions are made a part of evidence in important legal cases, are called by the prosecution and defence and make their statements, upon the value of which as evidence the jury must decide. Now it most generally happens that the judge, who is a master of civil and criminal law, knows comparatively little of Nature's laws. The counsel, *pro* and *con*, are generally as unscientific as the judge, and the jury, as a rule, know even less of science than of law. To prevent their making mistakes on law points, it is the duty of the court to instruct the jury as to the law and the rules of evidence; and it is the duty of the jury to accept his instructions as correct in every particular, and, applying the rules of evidence to the testimony before them, to give a verdict in accordance with these rules upon the issues of facts involved in the case.

Experts, so called, are introduced for the purpose of instructing the jury upon matters upon which neither the court nor jury are supposed to be informed. If the experts, so called, differ in opinions and statements, the jury must judge of the weight to be given to each opinion and testimony, and the evidence of experts, like that of other witnesses, must be taken for what it seems to be worth.

This is, we believe, the rule as concerns such evidence in modern courts of law. It certainly works in a very peculiar manner, and, as applied, does, in our opinion, as often defeat as it helps the administration of justice. Besides, its effect is to throw odium upon science and those who are really scientific, as neither judge, counsel, nor jury are qualified to decide from the evidence given—unless very gross ignorance is exhibited—whether the witnesses are really qualified to testify as to the points upon which they presume to pronounce authoritatively.

To establish the qualifications of the witness as an expert, he is generally asked his age, profession, and experience in the matters upon which he is required to testify. If he swears he has been twenty years a professor of chemistry in some public institution, has practiced medicine a certain length of time, or has been an engineer in some industrial establishment for a stated period, he is thenceforward to the jury, an expert chemist, physician, or engineer, as the case may be; and if he is possessed of the *otium cum dignitate*, coupled with a free use of formulated expressions having the sound of profundity and learning to a juryman's ear, he may swear to any absurdity he likes, and the average arbiter of the jury box will gulp it all down as gospel. To be a professor in an institution of learning, ought to, but does not, always indicate professional acquirements. We all, probably, know some physicians of many years' standing, whom we would not invite to "throw physic to the dogs," if the dogs were *our* dogs. We have many of us met professed engineers who have hardly the qualifications requisite for a boiler tender. It is not what a man ought to know, but what he does know that renders him competent to give an authoritative opinion.

We have plenty of examples of the different, and even conflicting, evidence of this class of witnesses. The testimony taken before the coroners' juries in the celebrated *Westfield* case, is one. Truly, the average juryman must have had a good time in trying to reconcile the legion of theories and opinions ventilated in that memorable investigation.

In Albany, quite recently, one set of physicians swore that in death from abortion, certain *post mortem* appearances must inevitably appear. Another set of medical witnesses swore to just the opposite.

In Philadelphia we have had recently the spectacle of a professed chemist and toxicologist making an examination of the body of a man supposed to be poisoned, and carrying his investigations far enough to convince himself of the presence of antimony, and forgetting there was a jury and a public to be convinced as well, appearing on the witness stand without a particle of proof that he found it, except his bare assertion. The prisoner in this case was acquitted, on the evidence of other experts called for the defence.

In Albany, some twenty years since, a man was hung, for poisoning his wife by aconite, on the evidence of a professed chemist, who swore he obtained aconite by a process that never detected it before and never detected it since, and this, notwithstanding that other chemists swore that the process described would, so far from detecting, absolutely prevent the detection of aconite, were it present.

In a recent trademark suit, relating to the manufacture of mustard, Dr. Ogden Doremus, of this city, swore that mustard seeds contained over eleven per cent of starch. To prove it, he used a solution of iodine upon mustard placed on filtering paper, which paper gave, when tested, the characteristic reaction of iodine with starch when no mustard was present. The error in the experiment was pointed out by Professors Seely and Chandler. Dr. Doremus was aided by Dr. Austin Flint, who tried to confirm by the use of a microscope, what Dr. Doremus tried to prove by the iodine test. Dr. Flint swore that he could see the granules of starch by the use of a high power. Professors Seely and Chandler could not see any such granules, but they did see what they thought might have been fragments of the exterior envelopes of the seeds. Dr. Doremus has, in a letter since published, affirmed the presence of starch in mustard seed (he says nothing of the percentage), and attempted to prove it by a test which would give the same results with cellulose as with starch.

Now, in view of such facts as these, is it any wonder that the public is beginning to mistrust the value of this kind of evidence? Such a mistrust is based upon good grounds enough. As now presented to juries, the testimony of the both competent and incompetent witnesses, only serves to muddle their intellects, and to complicate rather than make plain the facts.

If it be necessary to give juries authoritative instruction on points of law, how can it be less necessary that they should be similarly instructed in matters involving scientific knowledge. To bring before them A, who swears to one thing, and swears to the truth, and then bring B, the charlatan, who looks and talks twice as wisely as A, and denies under oath all that A has asserted, is not to instruct but to mystify them. When Counseller X tells the jury in his address that something is law which is not law, the Court quietly corrects the assertion in his charge, and the correction has the weight of authority. The jury believe the judge and discredit Counsellor X. But when Charlatan B tells them something is science that is not science, the true, yet modest A's assertions are no more authoritative to decide the question than B's. The jury must decide, or rather make a guess, as to what is right or wrong; and the average juryman is rather more likely to guess wrong than right in matters of science.

Now there is a plain, simple, and practical remedy for this state of things. In all cases where there are points of law to be decided, there is an arbiter on the bench to perform that office. There should be an equally authoritative tribunal to decide on scientific points, a separate jury of experts, if may be, constituting, for the time, a scientific court, whose charge to the jury should be as authoritative as that of the judge. Would it not be refreshing to hear such a witness as the one mentioned above, who swore to finding aconite, disposed of in the following fashion "It is my duty, gentlemen of the jury, as foreman of the scientific jury in this case, to instruct you that aconite cannot be detected by the process described in the testimony of the witness. However much he may be convinced that he did so, it is contrary to known laws of chemistry to suppose that he so obtained it. You are, therefore, to dismiss from your minds the possibility of such a result, in your deliberations upon this case." Or perhaps this:

"The process sworn to by A will obtain arsenic from the stomach of a person poisoned by that substance. The process sworn to by B will not obtain it. A says that by his process he found no arsenic. B says he found it in a process by which he could not have found it. It remains for you to judge whether, if by an accurate method arsenic could not be found, the testimony of one who swears he found it by an impossible process proves its presence."

Let such a course be pursued, and we soon should have somewhat less of *pseudo* science on the witness stand, and true scientific testimony would become of real value.

BEET SUGAR IN THE UNITED STATES.

As our readers are aware, we have done our utmost to promote the establishment of this industry, and we may therefore, with all the more reason, rejoice at the encouraging statements of the Commissioner of Agriculture in regard to it, published in his monthly report for January. He regards the future of the industry as now mainly dependent upon the comparative profit of beet sugar and cane sugar manufacturing.

The introduction of this business into this country met with many obstacles, notwithstanding the remission of duties on importations of machinery intended for beet sugar making. Perhaps no branch of chemical manufacturing needs to be conducted with greater nicety; and as in the outset we had to depend upon foreign skill—much of it hardly fit to be called skill—there were many failures, and success has come slowly.

The pioneer experiment at Chatsworth, Ill., failed disastrously; yet at Freeport, in the same State, the lessons of that failure are being turned to such good account that success is confidently anticipated. At Black Hawk, Wis., a coöperative beet sugar manufactory is pushed with great vigor, and gives large promise of good results Bnt the most decided success has been met with in California, where two companies are in full operation, the California Beet Sugar Co. at Alvarado having produced over a million pounds of sugar in the second year of its operation. Success is also reported from the Sacramento Valley Beet Sugar Co. A third company is delayed from the difficulty of obtaining seed.

The percentage of sugar obtained from Silesian Beets raised in California is quite extraordinary. The superintendent of the Sacramento Valley Beet Sugar Co., Mr. S. Ehrenstein, states that an average shows a yield of from 13 to 14 per cent, and exceptional instances occur in which 18 per cent is obtained, a much larger yield than ever was obtained in Europe.

It seems from these facts that *the* sugar producing region of the West is to be California, that land of wonderful resources and unprecedented development. Though the beginnings are comparatively small, there is little doubt that they will prove the foundation of a gigantic interest. The struggles of the pioneers in this field have been severe, but those who have held out will be ultimately rewarded.

DRYING SUBSTANCES BY HOT AIR.

Drying by hot air differs very materially from drying either by confined, saturated, or superheated steam, which convey their heat to metal racks, cylinders, or pipes, the latter radiating their heat and thus reaching by it the material to be desiccated. It also differs in principle from that of drying by superheated steam forced into interstices between solid bodies or injected into solutions. The latter, as we have shown in a previous article, acts by its superfluous heat over that of normal, saturated steam, converting more moisture into steam, and itself passing off as saturated steam.

When hot air is injected into a solution, it parts with its heat slowly; decreasing in volume and taking up a portion of watery vapor, it passes off as warm, saturated air, or air loaded with moisture. The use of air in this way would be practically uneconomical, the application of the heated gas would be very imperfect, and could not compare in convenience even to the injection of superheated steam, to say nothing of that most admirable of modern contrivances for evaporating liquids, the steam jacketed pan.

But hot air blown through the interstices, between bodies wetted upon their surfaces, will dry them very rapidly. The general principles of such drying are as follows:

Air always contains a quantity of watery vapor, which quantity varies with the temperature, the formula expressing this variation being that, with every increase of 27° above 32° Fahr., the capacity of air is doubled.

Thus air at 32° holds suspended one 160th part of its weight of water as vapor; at 59° it holds one 80th part; at 86° it holds one 40th part; and at 113° one 20th part; and so on, the temperatures increasing in an arithmetical series, the common difference of which is 27°, and the quantities of vapor suspended increasing in a geometrical series, the first term of which, taking air at 59°, is one 160th of the weight of the air, and the common ratio of which is 2.

Now the specific heat of air under atmospheric pressure, or any constant pressure, does not practically vary between the limits of —22° and 392° Fahr., as proved by Régnault in his elaborate investigations on this subject. That is, the amount of heat necessary to raise the temperature of one pound of air one degree of the Fahrenheit scale, is the same for all temperatures between these limits, and this law holds good for all non-condensible gases, or gases that cannot be liquefied, by cold or pressure or both combined.

It takes $\frac{2375}{10000}$ of a heat unit to raise a pound of air one degree. To raise one pound of air, from say 59° to 113°, would take 12·825 heat units. At 59°, one pound of air holds one 80th of a pound of water, At 113°, it holds one 20th, hence, by the increment of 12·825 heat units, it has been able to absorb one 20th its weight minus one 80th, = three 80ths. Now if we add to it 25·650 more heat units, we shall raise its temperature 54° more, heating it to 167°, whereupon it will suspend one fifth part of its weight of watery vapor,—an increase of three 20ths of its weight, or just four times as much effect as was produced by a rise of temperature, of an equal number of degrees, from 59° to 113°.

In drying by air, then, it is economy to admit the air at as high temperatures as the substance to be dried will sustain without damage; and as fast as the air has taken up its specific load of moisture, to change it.

It is further evident that the temperature of the air should as far as possible be kept from falling during its passage; since if it does this, a portion of the moisture it first seized upon will be deposited before it escapes, and a portion of the due effect will be lost. It should also be allowed to remain in contact with the substance to be dried till it arrives at the point of saturation, for if ejected before this, a portion of the due effect will also be lost.

We have seen that 51·3 heat units absorbed by one pound of air at 59° raises the air to 167°, and imparts to it the power of absorbing fifteen 80ths of a pound more water than it first possessed. To convert fifteen 80ths of a pound of water at 59° into saturated steam, and thus remove it, requires 209·8 heat units, or more than four times as many as required for the removal of the same amount by heated air.

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When, therefore, mere surface drying is all that is sought, there is a clear showing in favor of heated air on the score of economy when only theoretical principles are considered. But practically there are many sources of loss in the use of air for drying that cannot well be avoided even by the best applications of the principles we have endeavored to elucidate; so that a practical comparison, of the economy of this system with that of steam drying, would give very different figures. There is no doubt, however, that for mere surface drying, the greatest economy would be secured by hot air properly applied.

THE AMALGAMATION OF ORES OF THE PRECIOUS METALS.

It has frequently been our duty to call attention to the great loss arising from the imperfect methods, now in use, of extracting gold and silver from their ores; and the waste has been so extensive, amounting probably to thirty-five per cent of the whole of the gold and silver mined since the first discovery of these metals in California, and the inefficient processes are still so much used, that this important subject is always demanding our attention, as well as that of miners and other persons immediately interested. Much, indeed, remains to be written and done with regard to the extraction of these metals before a system, worthy of the present age of metallurgical chemistry, will be generally practiced. These considerations give interest to a new utensil and process which not only have the merits of apparent simplicity and adaptability to their purpose, but are recommended to the mining world by a practical man having experience and knowledge in this field, whose communications on this and cognate subjects are known to all readers of the SCIENTIFIC AMERICAN, namely, Mr. Percival Stockman, of 322 Grand street, Williamsburgh, N. Y.

The metal mercury still retains its preëminence as a means of obtaining gold and silver by amalgamation; and although the use of zinc is well known, it is chiefly employed in combination with or subsequently to the quicksilver treatment. Mr. Stockman employs mercury, using specially selected chemicals to expedite the amalgamation, and treats the metalliferous earth in an iron caldron, similar to those used for evaporating cane juice in sugar manufacture, This vessel is intended to be set in brickwork, and to be heated by a fire beneath it. The caldron has a socket, cast on the bottom inside, to receive the end of a perpendicular spindle or shaft. Attached to this shaft near the lower end, so as to agitate the contents of the caldron, are three or more fans similar to those of a propeller. Power for driving the shaft is applied by gearing on its upper part. The object of these fans is to keep the pulverized metallic ore in constant motion. The ore is placed in the caldron with sufficient water to make it of a muddy consistency, and the mixture is boiled for fifteen minutes; and then, the ore being diffused in the water by the heat and by the agitation of the fans, mercury is introduced. This metal is immediately, by the same means that divided the earthy particles of the ore, dispersed into millions of minute globules, and the heat gives these greater facility for attacking the gold concealed in the earth.

Mr. Stockman states that, in the case of ore containing pure metal, the amalgamation by the above described process can be completed in one hour without the use of chemicals. But the valuable metals are frequently found in combination with the sulphurets of antimony, arsenic, and mercury, and with the pyrites of iron, copper, and argentiferous galena; and it is especially with regard to these more obstinate combinations that a new and thoroughly effective process is desirable. Mr. Stockman treats these, in his newly devised apparatus, by the addition of chemical preparations, chiefly chloride of sodium, nitrate of potassa, lime, bisulphuret of carbon, and any of the fixed or volatile oils. The latter is especially needed when orpiment (the sesquisulphuret of arsenic) is present in combination with the pyrites; and with a view to rid such ores of the arsenic, the introduction of muriatic acid in connection with sulphuretted hydrogen is recommended. As in the case of the pure ore, the mixture is allowed to boil for fifteen minutes; the quicksilver is then introduced, and the mass is again boiled for two hours longer. At the expiration of this time, a stream of cold water is introduced to precipitate the amalgam; and the whole mixture is allowed to pass, from an outlet in the bottom of the caldron, to a sluice containing a separator in which the amalgam is gathered. This amalgam is then ready for separation of the gold or silver by evaporation of the mercury in a retort. As it is well known that hardly any two ores are chemically similar, it is obviously impossible to give fixed proportions of the ingredients above mentioned; these quantities must be determined by the character and percentages of foreign matters found in combination with the metals.

To the imperfection of the extracting processes now in use must be attributed the disappointment and failures of of many of those who go to seek their fortunes in gold and silver mines. Such searchers frequently base their calculations upon assays, perhaps scientifically made, of small specimens of the ores; and they have then been surprised to find that the ore did not yield, by the old methods, so much as the assay by ten, twenty, or fifty cent. This difference discourages the miner, and perhaps induces him to abandon his operation; whereas the fact is simply that the process of the assayer was more efficient than that of the miner.

The importance of this subject cannot be overrated, and any information that will add to the knowledge already possessed by our readers, many of whom are extensively engaged in the interesting and valuable industries of gold and silver mining, will always be received with pleasure by us, and communicated willingly to the public.

THE KNOWLEDGE OF SPECIFIC HEAT APPLIED TO THE DETERMINATION OF VERY HIGH TEMPERATURES.

Among the most important investigations, for finding methods to determine temperatures so high that no practical thermometer can give a uniform and reliable result, are those founded on our present knowledge of the specific heat of bodies. When, for instance, we know the specific heat of a body which can resist the effects of very high temperatures, say platinum, and we take a mass of this metal of known weight, place it in a blast furnace, and when the mass has acquired the temperature of the furnace, we transfer it quickly to a vessel surrounded with a known weight of water, we have only to observe the rise of temperature of this water, by means of an ordinary thermometer, to find how many units of heat were transferred from the furnace to the water by the intervention of the platinum; and from this it is easy to determine the degree of heat to which the latter was exposed. Pouillet was the first to examine the specific heat of platinum, and he found that it differs for different temperatures, which is, in fact, the case with most substances, even with water; and the saying that a unit of heat is the heat required to raise the temperature of one pound of water one degree is only approximately correct; in order to express ourselves with proper scientific accuracy we must say: The unit of heat is the amount of heat required to raise the temperature of water from 32° to 33° Fah. Régnault found that the specific heat of water increases, in consequence of its expansion, with the rise of temperature, and that if accepted at 1,000 for 32° Fah., it becomes 1,003 when the water becomes heated to 200°, or near its boilingpoint.

The specific heat of platinum is approximately equal to that of gold and mercury (see page 372, Vol. XXV.); but in order to use the metal for the purpose of measuring heat, a correct determination is required, and this was elaborated by Pouillet by means of air thermometers of peculiar construction. We here give:

POUILLET'S TABLE FOR THE MEAN SPECIFIC HEAT OF PLATINUM.

From	32°	" 212°	0·03350
"	32°	" 572°	0·03434
"	32°	" 933°	0·03516
"	32°	" 1,292°	0·03602
"	32°	" 1,832°	0·03728
"	32°	" 2,192°	0·03813
"	32°	to 2,732°	0·03938

The table shows that the specific heat of platinum, when taken at the common temperature, is nearly one thirtieth of that of water, while at some 2,700° it is about one twenty-fifth.

In order to make this more clear, we will state it in other words: At the common temperature, 30 pounds of platinum, losing one degree of heat, will produce one unit, and thus raise the temperature of one pound of water from 32° to 33°; while at the temperature of the blast furnace, say 2,700°, only 25 pounds of platinum, losing one degree of heat, will produce the same results.

We must, in passing, draw attention to a fact of much importance in regard to the theory of steam economy. The above table shows that the same quantity of heat will not raise the temperature of a mass of platinum equally for all parts of the thermometric scale; and for water, there is a still greater difference. So one unit of heat, being accepted as sufficient to raise the temperature of one pound of water of 32° one degree, will not suffice to do this to boiling water. If such water is heated in a closed vessel from 212° to 213°, it will require 1·013 units.

It is thus seen that in the case of water, it requires one seventy-seventh part more heat to raise the temperature of water from 212° to 213° than from 32° to 33°, and that, in the case of platinum, it requires only one ten thousandth part more heat to raise the temperature from 212° to 213° than from 32° to 33°, while, for the very high temperatures, it takes about one hundredth part more heat for one degree of thermometric ascension.

Applying the knowledge attained to the determination of the temperature of a blast furnace, we have only to observe by the thermometer the moderate amount of heat diffused in a large mass of water by means of a comparatively small mass of platinum, possessing a great amount of sensible heat or very high temperature at the moment that it is taken from the furnace. It is evident that precautions must be carefully taken against loss of heat by radiation, and against any other exterior disturbing influences, and the determination is then very easy, as we will illustrate by an example.

Suppose we have heated a mass of one pound of platinum in a blast furnace, and left it a sufficient time to be heated to the temperature of the flame. Outside we have say ten pounds of water, kept at 32°, surrounded by non conducting material, and enclosed between the double walls of a vessel, in the interior empty space of which the platinum is placed immediately after it's withdrawal from the furnace. It is cooled without touching the water, and precautions are taken not to lose heat by evaporation of the water or radiation. Suppose now that, under the circumstances accepted, we find that, after a sufficient time has elapsed, the temperature of the ten pounds of water has increased from 32° to 43½°, or 11½°; this is, for ten pounds of water, equivalent to 115 units of heat, which, reduced to degrees in one pound of platinum of which the mean specific heat between 32° and 2,732° is equal to 0·03938 (see table), gives 115 divided by the latter number, or 2,920 for the degree of heat to which the platinum was exposed; so that the temperature of the blast furnace must have been 2,920° Fah. If the result of the calculation had given us a much lower temperature, say some 1,800, it would be necessary to renew the calculation with another coefficient of specific heat; in this case it would be 0·03728, which corresponds nearer to the specific heat of the temperature of about 1,800°, and would thus give a more nearly correct result.

This method gives at the same time the means of corroborating the specific heat of platinum in another way. If, namely, we make two experiments, in the same furnace and at the same temperature, with unequal quantities of platinum, we may obtain two equations of two unknown quantities, namely, one quantity the specific heat of the platinum, the other the temperature of the furnace. From these two equations, we may easily extract, first the specific heat in question, and secondly the desired temperature of the blast furnace. In this way, a few fragments of any substance able to withstand the heat of the furnace may be employed to determine its temperature. We reserve the further elucidation of this method to a future article.

SCIENTIFIC AND PRACTICAL INFORMATION.

VACCINE MATTER.

The terrible visitation of small pox, which has largely increased the death average in many of our cities, has created an unusual demand for vaccine lymph; and, moreover, it has drawn especial attention to the sources whence the virus is derived, and the need of obtaining it of the greatest possible purity. A Boston physician has recently found the applications for vaccine matter so numerous that he has devoted much time and attention to its propagation by vaccinating heifer calves. The animals chosen are between the ages of three and six months, and are selected with particular regard to their sound and healthy condition. As the disease affects the calf but for the short period of fourteen days, and as the pustules are ready for the lymph to be taken on the sixth or seventh day only, a considerable number, no less than three hundred, of calves are yearly required to supply the customers of this one collector.

The animal is thrown, and a portion of its abdomen is shaved clean; the virus is then inserted in small incisions about one inch apart. Vesicles are thus originated, and on the sixth or seventh day, the lymph can be removed by squeezing the spots with pliers. The exudation is carefully collected on ivory points. Hundreds of points can be prepared from one animal in this way. The crusts which afterwards form on the pustules are removed and fixed on gutta percha mounts, many surgeons preferring to communicate the vaccination by their use. In many localities, the vaccine disease has lost its vigor, and the operation is seldom followed by appearances of the cow pox; but the necessity of the latter as a prophylactic has called attention to the deficiency, and a supply fresh from the cow is valuable to ensure the taking of the vaccination.

A SUBSTITUTE FOR A RUDDER.

The screw steamer *India* of the Anchor line, plying between Glasgow and New York, put into Halifax, N. S., on February 23d. She had been twenty-seven days out from Glasgow, having lost her rudder on February 8th. Thirteen days afterwards, she fell in with the American fishing schooner *Joseph H. Chandler*, and lashed her to her stern, the schooner steering the strange vessel compounded of two craft dissimilar from each other in every respect.

EXPERIMENTAL SCIENCE AT CORNELL UNIVERSITY.

Professor Burt G. Wilder, referring to his request, published on page 49, current volume, encloses us some further suggestions for the guidance of such of our readers as may be able to forward him specimens:

"It sometimes occurs that the heads of rare and valuable animals come into the possession of individuals or associations, when only the skulls are to be preserved on account of the great expense of an alcoholic collection of brains. In such cases, for the sake of the brains, I shall be glad to open the skulls, by either vertical or horizontal section, as may be preferred, properly prepare them by maceration, etc., and return to the owners, free of expense."

The Professor desires also to mention that 500 copies of a circular nearly like this were distributed during the past month, and kindly copied by many scientific and agricultural papers; already specimens and letters of inquiry and information are arriving from all parts of the country and from all classes of people. In fact, the museums contain but a very small proportion of the valuable scientific material of a country; every village has its malformations, which are there regarded as mere curiosities and gladly put into the hands of scientific men when asked for; every hunter, butcher, and farmer has it in his power to furnish most interesting specimens every year, and according to Professor Burt's experience, is glad to do so, when assured of their scientific value.

COLEMAN, RAHM & Co., of Pittsburgh, Pa., have put into use Stearn's smoke burner improvement, in connection with some of their iron furnaces, and find that it heats the iron quicker, with a less quantity of coal, and prevents the smoke nuisance. The estimated total saving in time and fuel, by the use of the invention, is thirty-three per cent. There are about one thousand furnaces in operation at Pittsburgh. If the smoke nuisance could be abated, and money saved in the doing of it, Pittsburgh would become famous.

RECENT letters from Professor Agassiz report the safe arrival of his exploring ship at Pernambuco, Brazil. His explorations of the sea bottom are continued with undiminished zeal. He has made many discoveries of fossil and live animals, sponges, etc., the mere nomenclature whereof is enough to break the uninitiated jaw.

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PSYCHIC FORCE.---SPIRIT FACES.

One of the marvels of spirit jugglery, or "psychic force" as the learned Dr. Crookes denominates it, is the production of images of human forms, hands, arms, faces, etc., which are seen by the observers to float around in the air. In some cases, the faces have been recognized as those of departed friends by sitters in spiritual circles. Quite a thriving business is done in this city by professors of the art; but some queer revelations have lately been made. One Gordon carried on a spirit establishment and was doing a profitable business, at 50 cents a head, until his partner, the business manager, in a quarrel peached on him, and revealed to the public how the thing was done. Professor Gordon, it appears, dressed in the paraphernalia of a high priest, appears before his audience, turns down the lights, and then by means of strings and hands manipulates a series of large lithographic colored pictures of faces, causing the pictures to rise from behind an altar, float and sway in the air. These pictures represent females, children and men, and in the dim twilight are from time to time pronounced, by this or that person in the audience, to be the spirit faces of their departed friends. Only a small stock of pictures is required to produce these supernatural effects.

A higher priced professor of this mystic art is one Slade, who until recently has confined his spirits to the more commonplace dodges of spirit-writing on slates, rapping, table lifting, accordeon playing, knife throwing, etc. His circles are more select, generally only two admitted at a time to the performance; tickets $3 each. Lately he has added on the the spirit face business and raised the price to $5. An intelligent friend of ours, who visited the show, pronounces the faces to be those of genuine spirits, and regards the whole performance as most astonishing. He came away completely converted to the doctrine of the bodily presence and power of the spirits. *Per contra*, the New York *Sun* recently published an *exposé* of Slade's manipulations, as derived from a member of his own household. The faces are produced behind a black curtain, and make their appearance before a small opening in the same. Slade employs a stock of masks and pictures, which he works by means of threads, making them rise and appear before the opening, the gas being turned down so as to give a dim, sepulchral effect. How it is, that any intelligent person can be brought to attribute these tricks to spiritual agency, passes comprehension.

The following letter, evidently from a believer, gives perhaps as good an explanation of the matter as any that has been made public:

THE SPIRIT FACES.—THEIR APPEARANCES EXPLAINED.

To the Editor of the Scientific American:

One who has tested many phases of spirit communion, and who has been through varied experiences herself, feels that she can give an explanation of the so-called spirit faces, produced by means of paper pictures by Gordon, Slade, and other mediums. Through the science of mesmerism, the spirits of our departed friends can, as I believe, act upon the optic nerves of those in the body. The psychic force, emanating from the medium, forms an atmosphere which acts upon the brain of the sitter, and a real portrait may be thus transfigured in the mind of the sitter and made to resemble the form of the departed one.

In my own experience, I have been attracted to look at ordinary pictures hanging upon the wall, and my eyes have been somehow affected by the mesmeric influence, until the pictures have been transformed so as to appear to me like the forms of departed friends. This I call the science of magnetic painting.

I believe that Mesmer is now acting upon the earth.

The mysteries of science are yet unfathomed.

Electricity, mesmerism and magnetism are combined in this new science, and will carry humanity onward and upward in its search after truth. H. E. B.

March, 1872.

AMERICAN DISTRICT TELEGRAPH COMPANY.---A NEW ENTERPRISE.

A novel enterprise has been inaugurated in this city, which we are confident will not only be a great public convenience but prove remunerative to the company organized to conduct it.

It is proposed by this company to place, in private dwellings, stores and offices, a telegraphic signalling instrument, by which communication may be established with one or other of a number of district offices located in New York and adjacent cities, and which will summon a messenger or policeman, as may be required, the district offices being so located that the call may be responded to in three minutes' time. Thus a person, awaking and becoming conscious of the presence of thieves in the building, may quietly touch a key at the head of his bed and summon assistance. Or, in case of sickness, he may have a messenger at the door in an equally short space of time, no matter at what hour of the day or night; or, if messengers are required for business purposes, they may be summoned in like manner, this being in our opinion the most useful feature of this plan, which, if well carried out, will prove a great convenience to the business public.

The apparatus, placed in dwellings, offices, etc., requires no attention, the battery and other fixtures, besides the signalling apparatus, being under the sole care of the company's employees at the district offices. The service is rendered for a small sum, payable monthly by each subscriber. The general offices of this company are at 62 Broadway, New York, and 185 Montague street, Brooklyn. Sub-offices are to be established throughout New York and Brooklyn.

A New Gun Cotton.

Some experiments for showing an improved quality of gun cotton, as made by Mr. Punshon, took place within the last few days at Wormwood Scrubbs. Mr. Punshon claims to be able to produce a gun cotton of any required explosive quality, so as to suit any purpose for which it may be wanted, and at the same time insure perfect uniformity of manufacture. He also states that by his treatment the difficulty of stowage is got rid of, and that his gun cotton may be stored dry without any liability to decomposition and consequent spontaneous explosion. He accomplishes his objects by covering the particles of gun cotton with sugar, with chlorate of potash or other salts, so as to separate the particles of cotton, and by varying the proportions and quantities of these materials to suit the special explosive quality required. These experiments, however, were simply to test the quality, of the cotton as prepared for rifle shooting, compared with gunpowder. The cartridges contained fifty grains of cotton, and were tried against gunpowder cartridges containing fifty, seventy, and eighty-four grains. The first trial was against a target composed of fourteen pine boards, of one inch thick, clamped together, and at twenty-five yards' distance. In this case, the bullets in each instance passed through all the boards, and splashed against the iron target behind; but at longer distances, up to two hundred yards, the gun cotton still penetrated, while the gunpowder cartridges containing seventy, and ultimately eighty-four grains, had to be used to effect the same amount of penetration. At five hundred yards, the shooting from the shoulder with the gun cotton cartridges was regular and good.

Fidgety Nurses.

It is almost better for a sick person to be without an nurse at all than to have in the room a fussy fidgety one, who gives the poor invalid the feeling of living in the midst of the whirlwind. That it proceeds from the nervousness and anxiety of affection is no comfort, and indeed is often only an aggravation, for the fresh worry that the poor nurse is sure to throw herself into is a check upon the expression of uneasiness or additional illness which is often a relief. Real affection, united with common sense, will produce the steady, calm demeanor which is such a rest and comfort to those who have to struggle with the nervousness and irritability incidental to severe illness. Want of presence of mind says the *California Farmer*, in a sick room is productive of more evils than distress to the invalid. The fussy easily agitated nurse will be quite overwhelmed by the sight of a fainting fit, or the bursting afresh of a vein after bleeding; she will forget the simplest remedies, or be too nervous and too faint to apply them properly; she is always in danger of mistaking medicines, and sometimes give a lotion internally, and carefully rubs on a tonic or a soothing draught. It is no exaggeration to say that far more suffering, and even loss of life, has been caused by want of composure and presence of mind in a sick room, than by negligence.

A CHURCH ON WHEELS.—A London vicar proposes an itinerating church, to reach the neglected masses. A large furniture van, with a belfry and seats and other fittings, holding thirty or forty persons, is to pass from street to street, gathering a congregation and holding worship in one place, outrunners preceding it to invite attendance, and then pass on to repeat the same in another locality; and so from hour to hour, filled and emptied, teaching a great number who will not come even to chapels or to Bible rooms.

IT is a very curious fact that many people—capitalists especially—have an impression that invention and mechanical design are somehow outside of the range of the reasoning faculties, that they are a sort of inspiration or *afflatus* which comes over a man in an inexplicable way, and that probably the less common sense or wisdom a person may have, regarding other matters, the better must he be as an inventor. Many who have entertained such impressions have had bitter reason to mourn that they based their faith on so insecure a foundation. The successful application of an invention requires, in fact, an exercise of the reasoning faculties quite as much as, or perhaps more than, a lawyer's argument in court; and the conclusion of the inventor should be as carefully sustained by evidence as is the lawyer's case.—*Railway Gazette.*

OBJECTIONS are urged by some that science has not improved the condition of the multitude, and that its benefits are limited to the body only. But surely this is not so. The more the intellect is developed, the more is man indisposed to make sensuality his aim. Whatever lightens human toil, sets free a portion of the intellect to bask in the light of its native element, and relieve some weak part of humanity from the stress of temptation. It is impossible to obtain a high standing in science without moral training.

RED RIVER RAFT.—The immense raft which has so long obstructed the Red River appears to move up stream instead of down, the motion being at the rate of about two miles in a year. The explanation of this retrograde movement is that the logs of the lower end of the raft are continually broken away and carried off by the flood and freshets, while the other end is constantly receiving additions. Thus the raft, always falling away at one end and growing at the other, gradually moves up the river, and it is calculated that it has moved since its forming about four hundred miles. In 1833, when the raft was 124 miles long, the work of removing it was commenced by the Government, but after working at it for twenty-two years, the attempt was abandoned as impracticable, and was confined to opening some of the lateral channels so as to facilitate navigation.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—DYEING FURS.—How can I dye furs a permanent black?—K.

2.—MARBLEIZING SLATE.—Will some one tell me what materials are used for this process, and how they are prepared and applied?—P. P. G. G.

3.—COINS.—Can any one tell me how to detect the dates on old and worn coins?—L. B.

4.—TANNING RABBIT SKINS, ETC.—Can any one tell me a cheap and simple way of tanning the skins of rabbits, musk rats, etc?—L. H. S.

5.—PRESERVING NATURAL FLOWERS.—How can pressed and dried flowers be made to preserve their colors?—H. P.

6.—LICORICE.—I wish to have information on the cultivation of licorice, and as to how the seed may be procured.—P. F. D.

7.—HARDENING MILLSTONE PICKS.—Can any one inform me of a process for hardening steel picks for French burr stones, or state where I could get such information?—L. P.

8.—HEAVY GUN.—What is the weight of the heaviest gun ever cast in the United States? What is its caliber; and what is the weight of its solid shot?—J. E. H.

9.—SAW DUST FOR DEAFENING WALLS.—Will some of your correspondents please inform me how to render saw dust non-combustible, to fit it for use in deafening dwellings, etc., also to make it proof against mice and other vermin?—L. M.

10.—DESTRUCTION OF GALVANIZED IRON.—Please inform me if there is a magnetic or electrical influence operating continually in galvanized iron, tending to destroy it?—D.

11.—HYDROGEN.—How can I obtain nascent hydrogen, or where can I see full descriptions of the different ways of producing it?—J. G.

12.—EXTRACTING INK MARKS.—How can I remove ink marks from green paper without destroying the original color?—J. J. M.

13.—WATER FOR AQUARIA.—Can any of your readers tell me how to keep the water in my aquarium pure and clear without changing it? It can be done.—C. D.

14.—TRUEING GRINDSTONES.—Is there any reliable method of hacking or keeping grindstones true without stopping them?—A. J. P. S.

15.—PREVENTION OF FREEZING.—What can I put into cider or vinegar to prevent its freezing? I want something not injurious in use, and other than alcohol.—J. R. D.

16.—TRANSFER VARNISH.—What is the proper composition to use for transferring illustrations from paper to copper and steel? It is only required to transfer an outline or general impression.—D. B. K.

17.—TRANSFERRING TO GLASS, ETC.—Can prints from steel or wood engravings be transferred from paper to glass, wood, or other material? And how is it done?—K. W.

18.—ELECTRO-CHEMICAL TELEGRAPH PAPER.—How can the marks on electro-chemical telegraph paper, moistened with a solution of iodide of potassium, be rendered permanent? Can any chemical be added to the solution to effect this?—G. B. M.

19.—TEST FOR NITRIC ACID.—What is the simplest and best test for nitric acid in any solution? Is litmus paper reliable when the quantity of acid present is very minute?—P. C. H.

20.—ANTS AND MOLES.—Can any of the readers of the SCIENTIFIC AMERICAN inform me how to destroy ants about the house, and moles in the garden? Thousands would like a practical answer to both enquiries.—T. M. G.

21.—BLOWING OUT BOILER.—At what pressure would it be safe to blow out a 24 horse boiler, carrying 60 pounds steam?—D. & N.

22.—WATER FEED TO BOILERS.—Would it not be advantageous to pump into a boiler just so much water as is evaporated in the production of the steam we are using? If we should pass air into our boiler with the water, what would be the result? Would it b beneficial or injurious?—D. & N.

23.—BLACK WALNUT DOORS.—When these have had the grain filled and received a coat of shellac and another of oil, on exposure to the sun they become light colored. Is there anything that can be put on to make them darker, or at least to prevent them from becoming lighter? I oil them every few months, but the shellac seems to keep the oil from striking in.—F. C.

24.—TEST FOR LEAD IN WATER.—Is there any way in which I can test rain water for lead? It goes through a lead pipe that has not been disturbed for more than 40 years. Suppose I boil down a couple of gallons to a gill or less, can I not apply some test to it?—F. C.

25.—CLEANSING HAIR BRUSH.—How can a hair brush be cleaned without injuring the stiffness of the bristles?—F. C.

26.—TEMPERING SPRINGS.—Will some reader of the SCIENTIFIC AMERICAN inform me how to secure in a carriage spring, after it has been mended, the desired temper? I would also like to know an approved plan for obtaining the right temper in the main spring of a gun lock.—J. H. S.

27.—FRUIT JELLIES.—Will any of your readers inform me how fruit jellies are made? They are extensively sold in the grocery trade. I should like to know of what fruit they consist, as they evidently are not made of the varieties after which they are named. Perhaps the currant is an exception to this.—M.

28.—CEMENTING GROUND EMERY TO WOOD.—Will some of your many readers inform me how to apply ground emery to wood for the purpose of grinding wood under water? How long will it last? Would it be durable or not, if run at about 200 revolutions per minute, under a pressure of 300 pounds of wood.—J. J. T.

29.—MOUNTING CHROMOS.—I wish to know the mode of mounting chromos. How are the chromos put on the canvass and stretched on the frames so that, when they are dry, they will be as tight as a drum head? I have tried putting them on wet, and, when they are dry, they are loose. Will some of your readers give me the whole process?—J. W. B.

30.—CLEANSING BOILER.—Immediately after blowing out a boiler at a pressure of from 50 to 60 pounds, would it be prudent to rinse out with water passed through a heater, say heated to 40 degrees or luke warm? If not right, what would be the consequence?—D. & N.

31.—PACKING RINGS.—Would you consider it right to place ordinary brass packing rings (such as used in locomotives) in the cylinder of a stationery, so as to allow them to turn, and not make them fast to the inside ring or fast to each other by feather, steady pin, or otherwise? This would allow them to work around, independently of each other and the said inside ring. If so, what would prevent the openings in the brass rings working around opposite each other, thereby allowing the steam to blow through?—D. & N.

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Examples for the Ladies.

Mrs. Elizabeth A. Monaghan, of Brooklyn, N.Y., has used her Wheeler & Wilson Machine since 1861. During the war she stitched forty blouses a day of eight hours, averaging about $16 a week: since then she has stitched from thirty to thirty-six linen coats a day. Last year, in three months, she stitched 1274 linen coats, earning $186.46, besides doing her own housework and tending her baby. She would use no other Machine.

Mrs. C——, of New York, has used a Wheeler & Wilson Machine since 1857, never averaging less than $700 a year, and for the last five years $1,000. She used the same needle during 1870, and earned with it over $1,000.

The Sweet, Fixed Oil of the Cocoanut is represented in *Burnett's Cocoaine.*

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Boiler and Pipe Covering manufactured by the Chalmers Spence Non-Conductor Co. In use in the principal mills and factories. Claims—Economy, Safety, and Durability. Offices and Manufactories, foot E. 9th street, New York, and 1202 N. 2d street, St. Louis, Mo.

Pattern Molding Letters (metallic), to letter or number castings. All sizes. H. W. Knight, Seneca Falls, N. Y.

Wanted—To invest $5,000, or less, in business—manufacturing preferred. Would join a practical man in starting. Business experience and capacity—references. D. Nelwin, Boston, Mass.

J. H. Preston, Jefferson City, Mo., wants to know where whangs or thongs are made.

To Sash, Door, and Blind Manufacturers in the Southern States: A man, who thoroughly understands the above business, wants a position as superintendent, or as foreman. Good reference can be given. Address N. White, Meadville, Pa.

The Tools that sell—Patent Star Bevels and Star Try Squares. Acknowledged by all to be the best Tools in the market. G. W. Hailett & Co., West Meriden, Conn.

Valve Refitting Machinery, sold by C. F. Hall & Son, sole manufacturers of the only original Patent Machines. Office, 21 Murray Street, New York.

Contractors for the removal of buildings, entire, are requested to communicate with I. H. McHenry, Pikesville, Md.

Cutlers' Grindstones, machine made—J. E. Mitchell, Phila., Pa.

Wickersly Grindstones, very cheap—J. E. Mitchell, Phila., Pa.

For Cheap Process to anneal small hard Castings in ten minutes, send 50 cents to J. C. Spencer, Phelps, N. Y. Will file easily.

Cast Steel Reaper and Mower Guards are made by the Pittsburgh Steel Gasting Co., strong as bar steel, and cheaper than wrought iron guards. See advertisement.

Sixty per cent allowed canvassers for Carpentry Made Easy, a valuable work for scientific men and mechanics. Howard Challen, Publisher, 521 Minor Street, Philadelphia, Pa.

Manufacturers and Mill Supplies of all kinds. Greene, Tweed & Co., 18 Park Place, New York.

The "Railroad Gazette" of March 2 contains a full page engraving of a Car Wheel Borer. Also much information of value to Engineers and Mechanics. Single copies, 10c. Address, 72 Broadway, New York.

The "Safety" Hold Back for Carriages prevents runaway accidents. See Sci. Am. Feb. 24, 1872. Undivided Interest, or State and County Rights, for sale. Address N. W. Simons, Williamsfield, Ohio.

Lord's improved Screen or Separator—also Watchman's Time Detector. For particulars, address Geo. W. Lord, 232 Arch St., Phila., Pa.

Scale in Steam Boilers. We will remove and prevent Scale in any Steam Boiler, or make no charge. Geo. W. Lord, 232 Arch Street, Philadelphia, Pa.

Walrus Leather for Polishing Steel, Brass, and Plated Ware. Greene, Tweed & Co., 18 Park Place, New York.

An Engineer, experienced in designing and constructing Engines, Boilers, and general Machinery, desires a permanent position as superintendent or head draftsman. Is practical machinist, and familiar with Indicator. Refers to leading concerns. Address, M. R., P. O. Box 5,652, New York.

Send samples of your Boiler Scale to Richard H. Buel, Consulting Mechanical Engineer, 7 Warren St., New York, who will find a method of removal or prevention, at moderate charges.

Gage Lathes and Wood Lathes. Wm. Scott, Binghamton, N.Y.

Null Lathes and Law Arbors. Wm. Scott, Binghamton, N.Y.

The Exeter Machine Works, Exeter, N. H., manufacturers of Sectional Boilers and Steam Engines, will soon open, in Boston, Mass., a centrally located sales room, in connection with their works; and are willing to take the agency of a few first class Machines and Tools not already introduced in that city.

For Diamond Turning Tools, for Emery Wheels and Grindstones, address Sullivan Machine Co., Claremont, N. Hamp.

Grindstones for manufacturing purposes a specialty—made by Worthington & Sons, North Amherst, Ohio. Send for price list.

Standard Twist Drills, every size, in lots from one drill to 10,000, at ¾ manufacturer's price. Sample and circular mailed for 25c. Hamilton E. Towle, 176 Broadway, New York.

For Best Galvanized Iron Cornice Machines in the United States, for both straight and circular work, address Calvin Carr & Co., 26 Merwin St., Cleveland, Ohio.

Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24 and Nov. 20, 1869. 64 Nassau st., New York.

Railway Turn Tables—Greenleaf's Patent. Drawings sent on application. Greenleaf Machine Works, Indianapolis, Ind.

Peck's Patent Drop Press. For circulars address the sole manufacturers, Milo, Peck & Co., New Haven, Ct.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro, 414 Water st., N.Y.

Presses, Dies, and Tinners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N.Y.

Over 1,000 Tanners, Paper-makers, Contractors, &c., use the Pumps of Heald, Sisco & Co. See advertisement.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 a year.

Hydraulic Jacks and Presses, New or Second Hand, Bought and sold, send for circular to E. Lyon, 470 Grand Street, New York.

For Hand Fire Engines, address Rumsey & Co., Seneca Falls, N.Y.

Over 800 different style Pumps for Tanners, Paper Makers, Fire Purposes, etc. Send for Catalogue. Rumsey & Co., Seneca, Falls, N.Y.

Grist Mills, New Patents. Edward Harrison, New Haven, Conn

Taft's Portable Hot Air Vapor and Shower Bathing Apparatus Address Portable Bath Co., Sag Harbor, N.Y. Send for Circular.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Patent Interlocking Grate Bars—Used and approved in 5000 furnaces, in the principal manufactories in the United States. Superior to all others in durability, and economy of fuel. No economist can afford to do without them. Address Salamander Grate Bar Co., 32 Broadway, N.Y.

Asbestos and Silicate of Soda in large and small quantities. E. D. & W. A. French, 3rd & Vine Sts., Camden, N. J.

In the Wakefield Earth Closet are combined Health, Cleanliness and Comfort. Send to 36 Dey St., New York, for descriptive pamphlet.

Enameled and Tinned Hollow-Ware and job work of all kinds. Warranted to give satisfaction, by A. G. Patton, Troy, N.Y.

For Circular of the largest variety of Wood Planing and Mitre Dovetailing Machinery, send to A. Davis, Lowell, Mass.

Rubber Valves—Finest quality, cut at once for delivery; or moulded to order. Address, Gutta Percha & Rubber Mf'g Co., 9 & 11 Park Place, New York.

Williamson's Road Steamer and Steam Plow, with Thomson's Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

Boynton's Lightning Saws. The genuine $500 challenge. Will cut five times as fast as an ax. A 6 foot cross cut and buck saw, $6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

Blake's Belt Studs. The best fastening for Leather or Rubber Belts. 40,000 Manufacturers use them. Greene, Tweed & Co., 18 Park Place, New York.

Hoisting Engines. Simplest, cheapest, and best. Send to John A. Lighthall, Beekman & Co., Office 5 Bowling Green, New York.

L. & J. W. Feuchtwanger, 55 Cedar St., New York, Manufacturers of Silicates, Soda and Potash, Soluble Glass, Importers of Chemicals and Drugs for Manufacturers' use.

New & Improved Bolt Forging Machines, J.R. Abbe, Prov., R.I.

The N. Y. Manuf'g Co., 21 Courtland St., N.Y., buy, sell, and manufacture Patented articles. Illustrated Catalogue, 48 pages, free.

Patent Rotary Engine; for all purposes, two to one hundred horse power; equal to any, for less price. Send for particulars and price list to John A. Lighthall, Beekman & Co., corner Imlay and Verona Streets, Brooklyn, N. Y.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4 00 a year. Advertisements 17c. a line.

Best and Cheapest—The Jones Scale Works, Binghamton, N Y.

New Pat. Quick and easy way of Graining. First class imitations of Oak, Walnut, Rosewood, &c. Send stamp for circular. J. J Callow, Cleveland, Ohio.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1 00 a line, under the head of "Business and Personal.

ALL reference to back numbers must be by volume and page.

T. N. L., of Va.—The mineral you send is ferruginous quartz—quartz containing iron.

BLACKING.—B. B. can find the information he seeks on page 170 of Vol. XXIV. of the SCIENTIFIC AMERICAN.

F. F. H., of N. Y., has omitted something in his letter, so that it is unintelligible.

S. L. A. M., of Ga.—We know of nothing that will remove the outer portion of the moss without destroying the texture of the rest.

CEMENT FOR CAST IRON.—Answer to query 6, February 17, 1872. If C. C. will take six parts of pulverized clay and one part of iron filings, make into a paste with boiling linseed oil, and apply hot, he will thus render his cracked vessels watertight.—J. J. M., of Pa.

CEMENT FOR CAST IRON.—C. C., query 6, February 17, can make this by mixing equal parts of salt and sifted ashes, and moistening them with water. Drive the cement into the crack with a mallet, and dry slowly over a fire.—M. L. B., of N. Y.

O. S., No. 14, February 24, 1872, will find a remedy for leaky roofs, whether of felt or other material, in the application of internal heat to the eaves, trough, and conductor, as may be seen upon my roof, No. 44 Whitesboro street, Utica, N. Y. Call and see how it works.—R. B. M.

W. E., of N. Y., is troubled with weak knees and exudation of the sinovial fluid, so that for their support he requires elastic bands.

L. P., of Mass., sends us a fragment of charred hair or wool, which has been used as steam packing, with the inquiry whether there is danger of fire from steam heating apparatus, in contact with combustibles. We reply that with high steam we think there is. With low steam we think there is not, unless substances liable to spontaneous combustion are laid against the pipes or heating racks.

L. H. P., of Chicago.—We do not think the accident of fire, occurring under circumstances as you describe them, was caused by the steam pipes. Our opinions upon this subject generally have already been fully expressed in recent issues, and we do not wish to reopen the discussion at present.

CEMENT FOR CAST IRON.—In answer to query 6, February 17, take one part fire clay and one part iron filings, mixed to the right consistency with muriatic acid diluted with a little water. The longer it stands before being used the better.—M. H. K., of N. J.

ENGINE POWER FOR CIRCULAR SAWS.—To NEMO, query 16, January 20: A ten horse engine driving a circular saw, cutting with the grain of the wood, will be equal to a fifteen horse engine cutting against the grain. If he will try it, the result will both satisfy and surprise him.—E. B. T., of Va.

CEMENT FOR CAST IRON.—To C. C., query 6, February 17. If the crack be in the bottom of the pot, drill a hole at each extreme end of the crack, to stop further cracking, plug rivet the holes with copper, and, with fine iron filings saturated with urine, calk the crack. I have tried this method on oil pots on board whale ships, with success.—C. F of Mass.

SAND IN DRIVE WELL.—In answer to query 24, February 17, let W. L. take a three quarter inch pipe and run it down inside his pipe to the sand; put on a force pump, and force water down. The sand will come out at the top of his pipe. Pump till the water is clear.—L. C. M., of Mass.

BORING CONICAL CYLINDER.—On page 122, of Vol. XXVI., No. 8, February 17, I. F. W. asks how he can bore out a cylinder forty inches long and twelve inches in diameter, diminishing one eighth of an inch in that length, with a boring bar ten feet long. If he will throw his bar three sixteenths of an inch out of center next to the face plate, he can accomplish what he desires, provided his boring bar has a feed screw on it, and he bores from the small end of the cylinder.—G. C.

G. D. B., of Pa., says: Enclosed you will find a specimen of something which I dipped out of a creek. It comes out in considerable quantities, and covers the whole bottom of the creek for fifteen or twenty rods from the place where it first shows, which is under a mill dam. A man that worked in the mill over twenty years ago says they used to get it on their clothes, and it could not be washed out. We have lately put in steam, and it gets into the boiler and bothers us some. Would you please tell me what it is?—G. D. B.—Answer: It is hydrous oxide of iron mixed with earthy matter. Is used somewhat for polishing purposes.

TEMPERING SPRINGS.—Judging from the character of answers to queries in your columns, as to the best method of tempering springs, and from other observations, I conclude that a great many mechanics think it necessary to repeat the process of drawing two or three times in order to get just the right temper. This is an erroneous idea. Once drawing to the proper color, after hardening in water, is sufficient, and any repetition is a waste of time and fuel; as, if the degree of heat applied does not exceed that required to obtain the right color in the first instance, the temper of the spring will remain the same after any number of subsequent heatings.—G. L. B., of Me.

F. C. S., of R. I.—Sulphur, like other remedies, should only be used as the choice of a lesser evil over a greater one. As an application for dandruff, which is the result of a diseased state of the skin, we have no doubt of its occasional efficacy. Like other remedies, it sometimes effects a cure, and when used in the proper manner, no injurious effects upon the hair need be feared. When sulphur is combined with metals, as lead for instance (with which it is often used as a hair restorer) the metal may by absorption produce ill effects upon the general health.

COMPOUND GEARS FOR SCREW CUTTING.—Permit me to say a few words in defence of the rule given by C. F., of N. J. I have made made my mind thoroughly familiar with its use, having composed indexes for different lathes, some of them containing over one hundred common and useful threads; and therefore I feel that on this subject I can speak with authority. This rule supplies a want long felt in machine shops, a rule which would at once and to a certainty tell whether a lathe would cut a certain thread. Let any one thoroughly master that rule, and he will be convinced of its merits. J. P. M. C., in condemning it, showed that he neither understood it nor gave it a practical trial. His objection of its taking so much time to work by is not a good one. I want only from one to three minutes, according to the fraction of thread. Now a word about the rule, which I have used for years, and which is the common rule all over the country, but which, though it is good so far as it goes, is often of no value whatever in the cutting of fractional threads, owing to the number of threads which can be cut by its use being extremely limited; while by the rule of C. F. there is almost no end to the number. Let J. P. M. C. work a few years in shops where jobbing of all kinds is done, where fractional threads are a common thing, and my word for it, he will find, as I have done, that the rule he gives is as far behind the requirements of the age, as the engine lathe of to-day is in advance of the hand tool of our fathers. He will then, instead of assuming superiority, indulge a humble and contrite spirit, and with others send thanks to C. F. and the SCIENTIFIC AMERICAN.—C. D., of Conn.

J. G., of N. J.—The nascent state of hydrogen or other gas is the state (by some thought an allotropic state) which the gas has at the moment of its liberation, either by electrolysis or ordinary chemical action, in which state gases act much more powerfully in combining than when once liberated and isolated. You will see therefore that this state exists in hydrogen at the moment of its liberation from combination, and that no particular process can be given for its production. A convenient way to illustrate the increased power of hydrogen at the instant of its liberation is to allow the gas, as produced from the decomposition of water by electrolysis, to pass into platinum sponge. The sponge absorbs it, and when placed in sulphate of silver, precipitates metallic silver, which ordinary free hydrogen will not do.

FRICTION GEAR FOR SCREW CUTTING.—To E. C. J., query 2, February, 1872. You cannot cut screws by friction gear, with sufficient accuracy for any purpose, except wooden screws. These should be finished with the first cut.—J. E. G., of Mo.

POUNDING OF PISTON.—I have noticed in "Notes and Queries" considerable discussion of the piston pounding question, and various theories have been advanced I have often removed the trouble by setting up the springs in my piston packing, thereby preventing the shaking back and forth at every change of the direction of motion.—E. L., of N. Y.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

ADVERTISING.—L. K. F.
BOON TO THE TRAVELLING PUBLIC.—H.
BUILDERS' HARDWARE.—A. T. S.
CLAPBOARDING.—E. S. W.
MODELS AT THE PATENT OFFICE.—A.
NATIONAL DEBT.—J. R. F.
ORIGIN OF DISEASE.—A. B.
PATENT SYSTEM.—A. S. L.
ROTARY ENGINE.—G. R. W.
SUN SPOTS.—J. B.
WEATHERBOARDING.—J. L. G.
WILD TEA.—G. Z.
ANSWERS.—S. T.—O. A. B.—H. J. C.—D. H. N.—M. M.—W. E.—J. K. B.—D. O. T.
NOTES AND QUERIES.—G. A.—F. H. F.—F. H. A.—E. F. G.—J. M.—C. M.—G. W. M.—A. K.—R. M.—L. D. M.—D. B. H.

Inventions Patented in England by Americans.

From January 31 to February 7, 1872, inclusive.
[Compiled from the Commissioners of Patents' Journal.]

SEWING MACHINE.—Howe Machine Company, Bridgeport, Conn.
SHUTTLE MECHANISM.—E. P. Terrell, D. B. Allen, J. Enoch, West Liberty, O.
SMELTING FURNACE.—S. W. Harris, Hudson, N.Y.
WEIGHING MACHINE.—A. H. Emery, New York city.

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Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

CULTIVATOR.—John R. Minter, Unionville, S. C.—This invention consists a combination of various devices, and the use of a cultivator tooth or shovel plow, the shank of which is slotted so that it may be moved up and down. It may be removed entirely when it is desired that the scrapers should straddle the row of cotton, corn, or other crop. For the first time going over the field with the cultivator, the row would generally be straddled, and consequently the shovel or tooth would be taken off; but for cutting and stirring up the entire soil surface between the rows, it would be put on. In the cultivation of cotton, it has been found extremely difficult to find a substitute for the hoe. The ordinary plows and cultivators are too inflexble and rigid to suit the purpose. With this adjustable implement, it is believed that the cultivation of the cotton plant will be greatly facilitated, and that it may be employed to good advantage in the cultivation of corn and other crops.

SHOE FASTENER.—Alexander Klinger, California, Mo.—This invention aims at providing for shoes and gaiters a hook attachment to receive the latchet or lacing string, which is so applied to the shoe or gaiter and secured to a metal plate as to avoid certain objections to other hook attachments, and attain advantages highly desirable in the manufacture of shoes. The device retains itself in place without aid of any other means, and the leather is punctured in but one place (which is done by a flat or cutting blade). The cheapness of such attachment, the absence of all liability to injure the shoe to which it is applied, and its capability of retaining itself in place, are claimed to recommend it above all others heretofore used or known.

CORN HUSKER.—Peter B. Snell, Manheim, N. Y.—A bench is supported upon legs of such a length as to raise it to a convenient hight. The side edges of the middle part of the bench are concaved to allow the operator to sit astride of it conveniently. To the upper side of the middle part of the bench is secured a metallic plate or casting, having two parallel upwardly projecting flanges, formed upon its upper part. The upper edges of the flanges are concaved between their centers and ends, to receive the ear to be husked. A lever is pivoted to and between the flanges, and passes down through a slot in the middle part of the casting and bench. Through the lower end of the lever is passed a pin, the ends of which project sufficiently to receive the foot or feet of the operator. To the upper end of the lever, a little above the casting, is attached a knife or cutter, having serrated or slotted edges. The cutter is attached to the end of the lever so that its edges may project upon the opposite sides of the lever, and so as to pass down alternately between the flanges as the lever is vibrated. In using the machine, the operator or operators sit astride of the bench at the end of the casting, and place their feet upon the pin of the lever. An ear of corn is then placed across the concaved upper edges of the flanges of the casting, in such a position that the knife, as it descends, may sever the butt of the ear, allowing it to drop from the husks. Another ear is then placed upon the flanges at the other side of the lever, which is husked in the same manner, and so an ear is husked at each movement of the lever.

DOUGH MIXER.—Reuben Kent, Portland, Me.—The object of this invention is to provide means for mixing dough in the manufacture of bread, crackers, etc. A cylinder, made in two parts, is employed, the parts being connected by a hinge and catch, and provided with a cover, a shaft, knives, stop pin, drawer and stand, all constructed, arranged, and operating for the purpose named.

COMPOUND BUILDING BLOCKS.—The object of this invention is to produce a very inexpensive building material which will rank with the very best in the country, both as regards durability and appearance, but will be much less costly and more durable than material which is only valued for its appearance. The invention consists in forming brick building blocks with stone, metal, or imitation stone faces, so that, when put upon buildings, they will constitute perfect and uniform blocks of greater strength and durability and with the desired appearance on the face. The building block is composed of a number of bricks, which are cemented or otherwise united together; and a stone, metal, or imitation stone face, if applied as a plate by cement or by mechanical fastenings, is secured to the block of bricks, and the entire block can then be conveniently transported to a suitable plaee, and put up as part of a building front. Such blocks can be formed in boxes or molds, wherein they can be put up by unskilled hands. When the ornamental face is made of composition, imitation stone, cement, plaster, or other matter, the mold should be formed to shape the compound in the desired manner. By this arrangement, it is claimed that cheap building fronts, richly ornamented or plain, can be made to order. Mr. Andrew Derrom, of Paterson, N. J., is the inventor.

MACHINE FOR PUNCHING METALS.—Gaspar Zender, Caledonia, Minn.—An annular die ring is provided, carrying dies of various shapes and sizes. A punch is provided for each die in case the latter vary in size or shape, and is readily detached when a different punch is required. When this is done, the die ring is turned on the bed, so as to bring the required die directly beneath the punch. When the die ring is thus placed, it may be held in position in any suitable manner. By this arrangement, holes of various sizes and shapes may be punched with a single machine without removing the dies. The advantages of this arrangement will be readily understood by all who are acquainted with the subject.

ELEVATOR.—Paul Giffhorn, Akron, Ohio.—This invention relates to a new endless ice elevator, for conveying ice from barges or sleds to sheds or ice houses; and consists of an endless double chain, provided with braced projections, and arranged on an inclined frame, which has a chute or guide at suitable elevation. A combination, with drums and double chains, having lugged and braced hooks of an inclined channel, formed of side bars and bottom, constructed and applied in a suitable frame, is the claim on which a patent has been allowed.

HOOKS AND EYES.—Miranda R. S. Davis, Kausas City, assignor of one fourth of her right to James P. Howe, Macon, Mo.—This invention relates to an improvement in hooks and eyes for fastening dresses or clothing, and for all purposes to which hooks and eyes are applicable; and it consists in the mode of fastening the hooks and eyes to the cloth or other material. The hooks and eyes are formed with two pointed shanks, which allows them to be inserted in the cloth the same as pins; and, when inserted, they are fastened either by bending the shanks over and down on to the cloth, bending over the eye or hook. No needle and thread are required. The improved hooks and eyes may be inserted and fastened almost as easy as common pins can be inserted, and, it is claimed, in the most substantial and perfect manner.

AMALGAMATOR.—George C. Langtry and George Emmett, Gold Hill, Nev.—This invention has for its object to produce an improved machine for pulverizing slime or mud containing gold and silver ores obtained in the preparatory dressing, tailing or the refuse part of stamped ore thrown behind the tail of the buddle or washing apparatus, or gold and silver bearing sand, and also to separate and amalgamate the precious metals therein contained.

COMBINED BUREAU, BEDSTEAD, BOOK CASE, ETC.—Herman Rocke, of New York city.—This invention relates to a new combination piece of furniture, which embodies within a reduced compass nearly all the requisites of a sleeping and dressing apartment and of a study, since it contains a bedstead, mosquito-net frame, wash stand, toilet case, mirror, table, drawers, wardrobe, spittoon, boot jack, writing case, writing table, and book case.

BALE BAND STRETCHER.—Logan J. Anderson, of Water Valley, Miss.—This invention relates to baling cotton, hay, and all other merchantable commodities which are usually transported and sold in bales; and consists in a lever, clamp, or stretcher so constructed that the ends of the bands are griped and drawn together, and the band is tightly drawn around the bale, for fastening or tying.

WRINGING MACHINE.—Martin Way and Frank Way, of Springfield, Ohio.—In this invention the power of the wringer can be held under constant and varying control, in accordance with the requirements of every single article passing between the rollers. A combination of a bench, wringer frame, tub, wringer rollers, rods, cross bar, lever, point, and treadle is employed to secure the desirable end.

BEE HIVE.—David Latchaw, of Barkeyville, Pa.—This hive comprises features which are not novel; such, for instance, as an arrangement of comb frames desigued to form a suitable enclosure for bees without the use of the usual cover or case; also, removable comb frames, with top bars, beveled on the under side, and with central cross bars; also, sectional "supers," or surplus honey boxes; also, inclined bottom board; but the invention consists in a peculiar construction of the feed box, which is a combination with the comb frames provided with bevel top bars, of the feed boxing, having notched end bars and honey receptacles, and a trough, the same being adapted to fit into said frames.

LAMP BASKET.—Patrick J. Clark, of West Meriden, CONN.—This invention consists of a combination of one or more springs with the metal baskets or cups of brackets for suspending lamp holders arranged to spring upon the annular bead or rib near the center of the lamps and hold them from being accidentally thrown out.

BAG HOLDER.—George W. Dungan and Warren Wasson, of Genoa, Nev.—This invention has for its object to furnish an improved device for holding bags, sacks, etc., while being filled with grain or other substances. It consists in the construction and combination of a movable bottom, flexible straps, levers, stops, perforated straps, hooks, and knobs or buttons, with a suitable frame work.

SULKY PLOW.—William B. Cummins, of Leon, Iowa.—This invention has for its object to furnish an improved sulky attachment for plows, which shall be simple in construction and easily operated to raise the plow from the ground for convenience in turning and passing from place to place, and to again drop the plow into working position.

STUMP EXTRACTOR.—Warren Beckwith, of Geneva, Wis.—The object of this invention is to furnish a machine for pulling stumps and raising rocks and other heavy bodies from the ground. It consists in the construction, arrangement, and combination of a frame, timbers, standards, windlass, pulley, and hoisting chains or ropes arranged to act with a standard shaft and block in combination with the standards.

CHURN.—David A. Willbanks, of Harmony Grove, Ga.—This invention is a combination, with a belt, connecting two pulleys, of a looped rod and pin to prevent the belt from becoming tangled when removed from the dasher rod, which is vertical, and rotates the dasher in a churn having the general form of a frustrum of a cone.

HARVESTER.—George W. Holmes, of Council Bluffs, Iowa.—This invention has for its object to furnish an improved device designed especially for facilitating the operation of the cutter bars of reapers and mowers. It consists in a pitman provided with springs and nuts, and also a bar and a two armed lever combined in a harvester with the cutter bar and the rock shaft that drives it in combination with a sliding and supporting frame.

PRESS.—William Randle, of Hadensville Station, Ky.—This invention relates to an improvement in presses, which consists in a novel arrangement of perforated bars, ratchet bars, pawls, and levers with a beam carrying the follower to actuate the latter by lever power.

BRICK MACHINE.—Henry Jones, of Fort Madison, Iowa.—This is an improvement in brick machines, which employs a combination, with a mold wheel, of a chain of mold closers, pressers, and curved bars with inclined planes, also a combination with the mold wheel and pressers of a curved bar, and an endless carrier, also mold closers hinged together in an endless chain by the flanges and pins, the latter being provided with rollers and combined with a support and wheel, also the mold closers have pins arranged for gearing with a toothed rim, and finally bars, housings, and supporting screws arranged in a peculiar manner, the whole being embraced in five claims, allowed on the patent.

LAMP.—Joseph M. Parker, of La Grange, Mo.—This invention consists of a lamp, the body of which is in the form of a frustrum of a cone, with an inverted frustrum of a cone at the top, and the opening at the top being very large, for allowing a free escape in case of an explosion, it being intended that the burner and wick tube, which are held in said opening by a hollow plug of elastic substance, shall be forced out vertically and relieve the lamp so that it will not be broken. The conical shaped body is used because of being more favorable for the expansion and contraction without fracturing than other form; and the concave bottom is used because water, which it is proposed to use as a safeguard against explosion, freezing in such a formed bottom, will not burst it, as the said form allows the expansion without straining the walls. The inventor claims that a lamp constructed on this plan will, in the first place, be scarcely liable to explode at all; and, in the second place, if an explosion does take place, the burner and flame will be forced away from the lamp in the most harmless direction, and the lamp will not be broken. He uses water in the lamp nearly up to the lower end of the tube; as any burning fluid, however volatile it may be under other circumstances, gives off but a very meager portion of carburet of hydrogen, even at a high degree of heat, when resting on a column of water, whereby the danger of explosion is very much lessened.

EXPANSION PIVOTS FOR WHEELS OF SEWING AND OTHER MACHINES.—Emanuel Motz, of Woodward, Pa.—This invention has for its object to provide against the wear of pivots or arbors in machinery, or of the wheels running thereon; and consists in making the same expansible by means of longitudinally adjustable ratchet keys placed around the pivot and within a split ring. The invention is claimed to be particularly useful for sewing machines and similar devices, as it counteracts the wearing of bearings and eyes of wheels, and consequent noise, rattle, and increase of friction.

PEDAL ATTACHMENT FOR PIANOS.—Nathaniel A. Stimson, of Herkimer, N. Y.—This invention has for its object to furnish an improved attachment for pianos, to enable a performer upon a violin, flute, or other instrument to play with his feet a piano accompaniment for himself. It consists in the construction and combination of pedals or foot levers, rods, cross bars, pins and levers with each other, and with a frame to adapt them for attachment to a piano, and to constitute a pedal action of the kind set forth.

COMBINED KNIFE AND FORK CLEANER, KNIFE SHARPENER, AND CAN OPENER.—Frederick W. Echternach and Milton J. Welch, of Philadelphia, Pa.—This invention is a combined knife and fork cleaner, knife sharpener, and can opener, consisting of a base, hard grit cakes, and a lever, pin cutter, and notched plate, all combined to form one implement.

SPARK ARRESTER.—Herman F. Reiner, of Blairsville, Pa.—This invention consists in a wire screen in the form of a frustrum of a cone, which is inverted and attached to the mouth of the smoke stack by its base, so as to extend downward therefrom to within a short distance of the base of an inverted funnel used for deflecting the sparks against the top of the stack, arranged suitably therefor, and receiving them from the sides of the screen after ter the force with which they are carried up is arrested; and below this funnel, which has a hole at the bottom, is an inverted conical cup, into which the sparks are received, to be again delivered to the blast and forced up to the top of the stack, as before, to be extinguished and broken, so as to be carried off through the screen with the smoke, this operation being repeated until the sparks are fine enough for being so carried off and the fire extinguished. The apparatus is specially designed for application to straight or cylindrical smoke stacks, which are much more preferable than those with flaring tops.

HORSESHOE.—Thomas Kinghorn and Robert Kinghorn, of Morgan, Ohio.—This invention consists of a horseshoe with joints about half way between the heel and toe, and india rubber springs arranged to force the heels outward when attached to expand feet contracted at the heel. The two sides of the horseshoe are jointed so as to approach to or recede from each other at the heel, and provided with projections having cavities adapted for holding a spring on each side, in such a manner that their being contracted by moving the heels toward each other when the shoe is attached to the foot, will constantly tend to spread the foot at the heel by their action thereon. Projections are so placed on the inner side of the bar forming the shoe as not to rise so high or extend so low as to interfere in any way with the wearing of the shoe. A spongeholder is used, consisting of a piece of leather formed mainly in outline like the inner lining of the shoe, but a little larger, with a depression for the frog, and provided with metal clips, having an upper prong and a lower one which engage the inner edge of the shoe above and below, and hold the said leather piece in position. The leather is sprung, to contract it when being introduced and the clips are engaged with the shoe, one of the clips being near each heel and the other at the toe.

Practical Hints to Inventors.

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How Can I Obtain a Patent?

is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows and correct:

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Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of yonr improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

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Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications or patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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5,557 and 5,558.—COOKING STOVE.—C. H. Buck, W. S. Wright, St Louis, Mo.
5,559.—SIDE FRAME FOR CHAIRS.—J. H. Travis, Charlestown, E. H. Mahoney, Boston, Mass.
5,560.—FIREMAN'S HAT.—C. D. P. Watters, New York city.
5,561 and 5,562.—CENTER PIECES FOR CEILINGS.—J. W. Reeves, Philadelphia, Pa.

TRADE MARKS REGISTERED.

667.—SOAP.—J. P. Babcock & Co., Stonington, Conn.
668.—TALLOW PACKING.—I. U. Coles & Co., New York city.
669 and 670.—SOAPS.—C. Davis, Cambridgeport, Mass.
671.—LIQUOR PACKAGE.—R. George, New York city.
672.—WATERPROOF MATERIAL.—A. A. Hawley, Methuen, Mass.
673.—NECK TIE, ETC.—Hurlbut & Shantz, Philadelphia, Pa.
674 to 676.—SPICE.—Stickney & Poor, Boston, Mass.
677.—COFFEE.—Stickney & Poor, Boston, Mass.
678.—SODA WATER APPARATUS.—J. W. Tufts, Medford, Mass.
679.—LEWING MACHINE.—Wilson Sewing Machine Co., Cleveland, O.
680.—SHOE BLACKING.—C. H. Young & Co., Boston, Mass.

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

20,254.—DAY AND NIGHT RAILROAD CAR.—J. B. Creighton. May 1, 1872.
20,277.—PAPER PULP MACHINE.—J. Jordan, Jr., T. Eustice. May 1, 1872.
20,364.—CLOTHES PIN.—D. Pierce. May 8, 1872.
20,385.—POWER AND HAND DRILL.—H. Woodman. May 8, 1872.
20,394.—HARVESTER.—W. H. Seymour and H. Pease. May 8, 1872.

EXTENSIONS GRANTED.

19,490.—COTTON BALE TIE.—F. Cook.
19,412.—CULTIVATOR.—P. Dennis.
19,420.—HORSE RAKE.—W. Horning.
19,465.—CARPET BEATING MACHINE.—J. Harris, Jr., D. Holmes.
19,417.—COTTON GIN.—B. D. Gullett.

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NEW BOOKS AND PUBLICATIONS.

HOW TO TREAT THE SICK WITHOUT MEDICINE. By James C. Jackson, M.D., Physician-in-Chief of "Our Home on the Hill Side." And TRAINING OF CHILDREN, by the same Author. Austin Jackson & Co., Dansville, Livingston Co., N. Y. Oakley Mason & Co., 21 Murray Street, New York.

These are works devoted to an exposition of what is styled by the author the psycho-hygienic treatment of the various diseases which afflict mankind, with a view not only to their cure but their prevention. Designed for popular reading, they are necessarily not exhaustive, but, in expounding the rules of temperance, cleanliness, and right living in every respect, they are calculated to do much good, and will repay perusal, even by those who could comprehend more profound treatises.

PLAIN TALK ABOUT INSANITY. Its Causes, Forms, Symptoms, and the Treament of Mental Diseases. With Remarks on Hospitals and Asylums, and the Medico-Legal Aspect of Insanity. By T. W. Fisher, M.D., late of the Boston Hospital for the Insane. Boston: Alexander Moore.

We have not yet had time to read this work, but from a glance at the various topics, and their manner of treatment, we are convinced it is a valuable work, which will repay the thorough perusal we intend to give it as opportunity offers. It is adapted for popular reading, is chaste and elevated in style, and is evidently the work of a skillful practitioner and close observer

ANIMAL AND VEGETABLE PARASITES OF THE HUMAN SKIN AND HAIR By Joy Jeffries, A.M., M.D., Fellow of the Massachusetts Medical Society, etc, etc. Boston: Alexander Moore.

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LOGICAL PRAXIS. Comprising a Summary of the Principles of Logical Science, and Copious Exercises for Practical Application. By Henry S. Day, Author of Elements of Logic, Rhetoric, Rhetorical Praxis, Æsthetics, etc. New Haven: Charles C. Chatfield & Co.

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The number for March is an exceptionally good one, containing a great variety of very interesting matter. Hawthorne's Story of Septimius Felton, third part, and Holmes' number three of the "Poet at the Breakfast Table," are worth, in themselves, the price of the magazine; but, in addition to these, there are contributions from De Mille, Nora Perry, J. W. Palmer, John G. Whittier, Longfellow, Bret Harte, Parton, and others well known to American literature.

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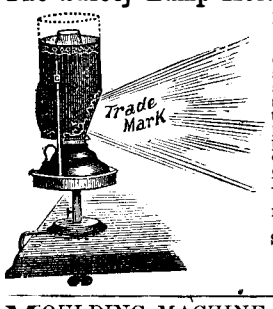

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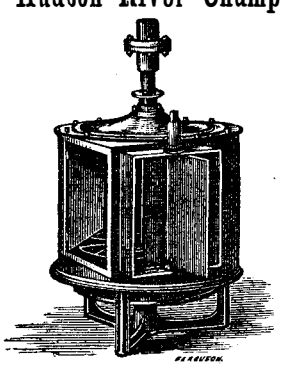

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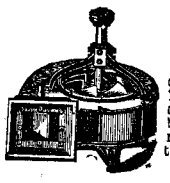

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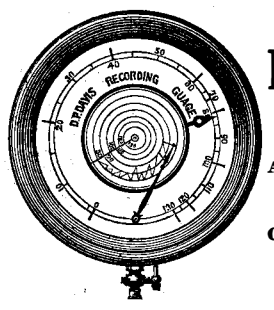

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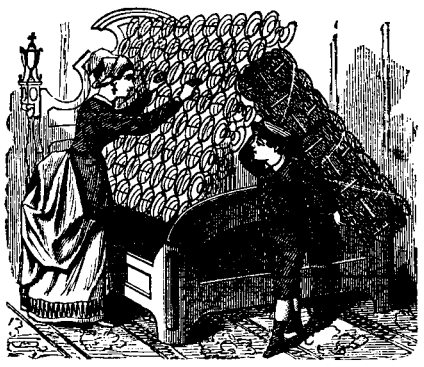

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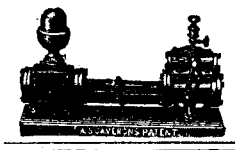

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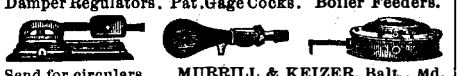

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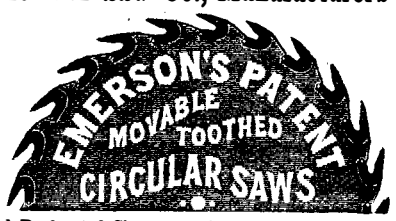

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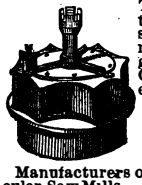

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